COMBUSTION

DEVOTED TO THE ADVANCEMENT OF STEAM PLANT DESIGN AND OPERATION

August 1952

Boiler drum arriving at Walter C. Beckjord Station; see page 81

Fernand Courtoy Power Station

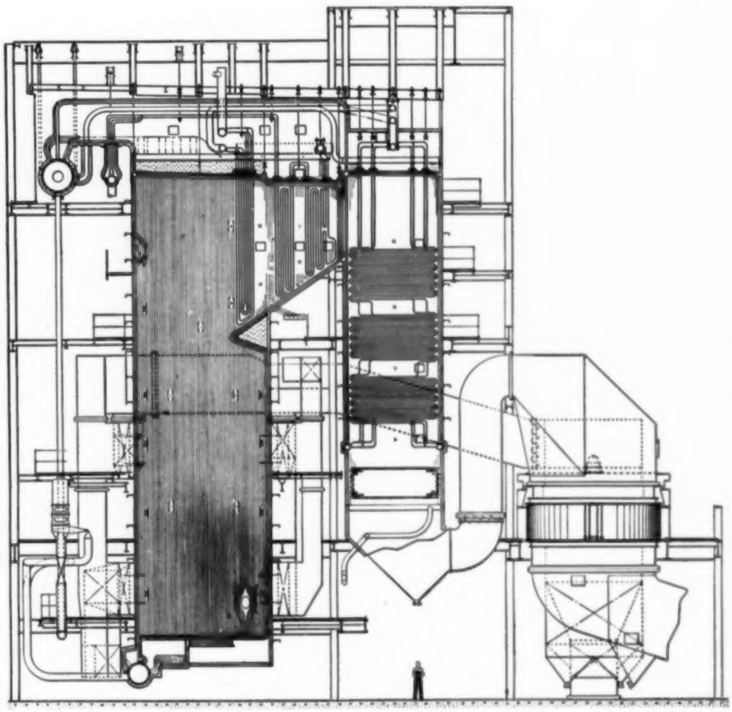
Series Dust-Collector Installations

Safe Continuous Flow of Centrifugal Pumps

ETIWANDA STEAM STATION

Southern California Edison Company

C-E controlled circulation boilers



The C-E Unit shown above is one of two duplicate units now in process of fabrication for the Etiwanda Steam Station of the Southern California Edison Company at Etiwanda, California. Stone & Webster Engineering Corporation are the engineers and constructors.

Each of these units is designed to serve a 125,000 kw turbine-generator operating at a pressure of 1800 psi with a primary steam temperature of 1000 F, reheated to 1000 F.

These units are of the controlled-circulation, radiant type with a reheater section located between the primary and secondary superheater surfaces. An economizer section follows the rear superheater section and regenerative type air heaters follow the economizer surface.

Oil or natural gas firing is employed using tilting, tangential burners. The design provides for future conversion to pulverized coal when and if desired.

C-E

COMBUSTION ENGINEERING—SUPERHEATER, INC.

200 Madison Avenue, New York 16, N. Y.

B-591

ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

COMBUSTION

DEVOTED TO THE ADVANCEMENT OF STEAM PLANT DESIGN AND OPERATION

Vol. 24 **No. 2**

August 1952

Feature Articles

Editorials

Departments

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COMBUSTION

Editorials

Industry Aid to Education

It is well known that university tuition falls far short of meeting educational costs, and that devaluation of the dollar, combined with inflation, has reduced the value of returns from existing private endowments. This was offset during the war and earlier postwar years by military educational programs and G. I. training, and later by contracts for government-sponsored research, many of which are still in progress. Numerous bills have been introduced in Congress, with presidential endorsement, to increase federal aid to education and there are also innumerable state scholarships. All these add up to vast sums without which some educational institutions would probably have had to close their doors.

However, such public assistance has created apprehension among some educators that we are headed for too much government paternalism, which may lead to an unhealthy situation. As Dr. D. W. Malott, president of Cornell University, aptly expressed it in addressing the E.E.I. Convention in June: "Slowly, almost imperceptibly, privately endowed education is being *drugged* by heady potions from the public trough."

As an alternative to federal subsidy, Dr. Malott suggested more widespread support from business corporations, the cost of which within five per cent limits is deductible from tax liability—a most important matter in these days of high excess profits. The direct contribution of a given sum by industry rather than the indirect contribution of a like amount through the medium of taxation and government subsidy would carry administrative advantages to the universities.

This is not to infer that industry-sponsored research by universities, or industrial endowment, has been lacking, but as Dr. Malott sees it, the time has arrived for its more generous and widespread application. This is particularly true as concerns engineering colleges at a time when the demand for engineers far exceeds the supply.

Establishing Authorship

Who should receive credit in writing a technical article? Should it be the engineer in responsible charge of the project? What about the person, be he junior engineer or professional writer, who actually puts the words together? And what sort of recognition should be accorded to the executive under whose leadership the project has been initiated and carried out?

It is a truism that no policy, however generalized and all-inclusive it may purport to be, can offer decisive answers to all of the questions which face publishers and editors in establishing and recognizing authors of technical papers. For example, does not the project manager deserve some credit if he is willing to spend time in supplying necessary data and later offers constructive criticism of the draft of a descriptive article dealing with the power plant for whose design he has been responsible? And, turning to research, is it not reasonable that a young engineer who has carried out many of the computations and written progress reports should receive recognition along with the director of research when details of the project are released for publication? Finally, are there not times when an executive officer, busied as he is with many duties and numerous callers, may rightfully be considered if he has the germ of an idea which another can develop with the assistance of the executive?

Ghost writing is currently in bad repute. Nevertheless, the reality that it is employed in some engineering society papers must be accepted, making allowance for the fact that there are some practical and, it would seem, justifiable reasons for its existence. As previously implied, this justification is a matter of editorial judgment, and each case must be decided on its own merits. In this manner authorship may be established on a basis that is both realistic and fair to all concerned.

From Steel to Coal

Coming in the wake of the steel strike, John L. Lewis has opportunely given sixty days notice, on behalf of his union, that the present contract with the coal operators will be terminated. He has not yet publicly announced his demands but, judging from past experience, they are likely to result in lengthy negotiations and possible interruption of coal production.

Fortunately, coal stocks in the hands of electric utilities are the highest on record. Figures reported on July first by the Federal Power Commission showed that in May the coal on hand was capable of lasting 153 days, or approximately five months, based on the current rate of electric output. As of this writing, they are probably appreciably higher. This, of course, represents an average. However, most industrials are in a much less favorable position, and now that steel operations are being resumed the demand of that industry is certain to be heavy—a fact which Mr. Lewis has undoubtedly taken into consideration.

The present contract went into effect in March 1950 and was for a period of two years after which it could be terminated on sixty days' notice. Since it is inconceivable that Mr. Lewis will be satisfied with other than a substantial increase in miners' wages and other benefits, one must look for further increases in coal prices this coming fall and winter. Meanwhile, coal should be purchased and not taken from stockpiles.

The FERNAND COURTOY Power Station at Awirs, Liége

This 100,000-kw station, built to serve a group of industrials near Liége, is constructed on the unit system with two boilers serving each of the two 50,000-kw turbine-generators. Steam is produced at 950 psig, 932 F. A mixture of low-volatile, high-ash coals from a number of collieries is burned in pulverized form through the bin-and-feeder system.

By Baron A. FORGEUR Chief Engineer

B.E.I. Fernand COURTOY-BRUSSELS

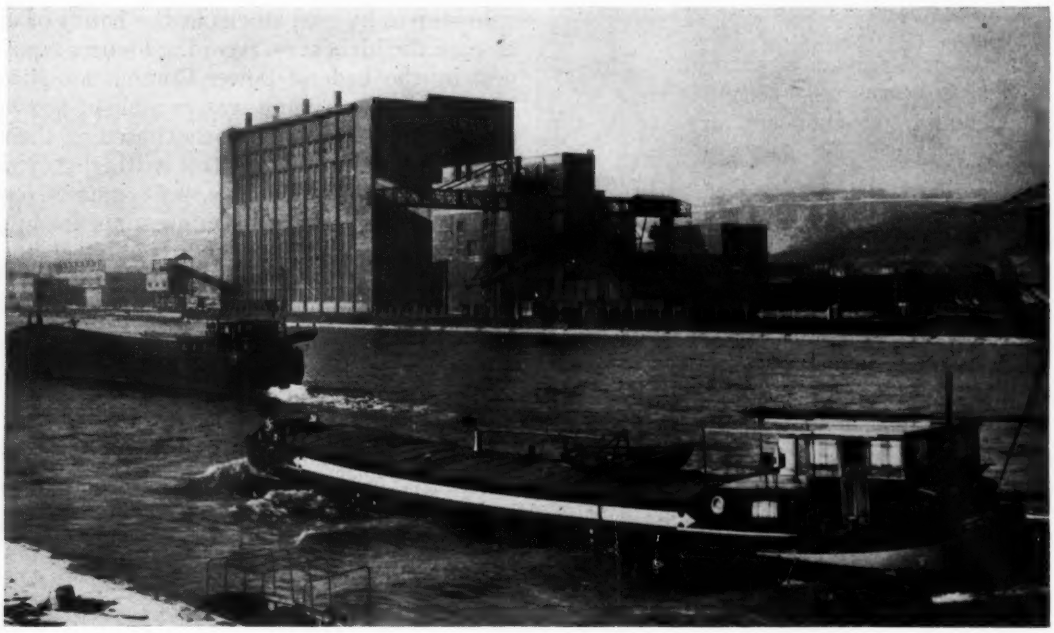
THE Union des Centrales Electriques de Liége-Namur-Luxembourg-U.C.E. LINALUX began in 1919 as a cooperative system between various privately owned power stations such as steel mills, collieries and other industries, with the aim of operating power plants at the lowest possible cost by parallel operation of the most efficient generating units. Gradually the system has expanded to the present state totaling 48 power producers and consumers with a generating capacity of more than 300,000 kw. These are located in the industrial districts of Liége and Luxembourg. The system is interconnected through the Union Générale Belge d'Electricité with other Belgian systems, also with Germany and France.

To satisfy the growing power demand, Linalux decided long before World War II, to build a 100,000-kw power station for the benefit of a number of industrial concerns and with their financial help. This was to replace old and obsolete generating units, particularly those at some of the collieries. It was imperative to use coal from different sources, some with an ash content as high as 35 to 50 per cent. However, the first orders were deferred till 1948 and work began on the site in January 1949. The first unit was started in June 1951 and the second in September of the same year.

Preliminary Considerations

In view of the main objectives of low first cost and low production cost, a conservative heat cycle was chosen. Steam conditions at the inlet to the turbine are 60 kg/cm^2 (850 psig) and 485 C (900 F) while feedwater temperature after regenerative heating is 194 C (380 F). Most 50,000-kw units on the Continent and in Britain have been designed to this standard, which procures a heat rate of less than 3000 calories (12,000 Btu) per kwhr net.

The power station contains two 50,000-kw units consisting each of a turbine-generator set with step-up transformer and two boilers. By providing each turbine with two boilers maximum flexibility of operation was assured, as well as high availability. Experience has shown that with European coals of very high ash and low volatile content the boiler availability is usually less than



View of Fernand Courtoy Station from across the Meuse

that of the turbine. Besides, European makers had, when the orders were placed, little or no experience with 450,000-lb per hr boilers for such steam conditions.

Each turbine-generator, with its two boilers, operates normally as an independent unit. But the steam and water connections are such that three boilers can supply steam at the rate of 840,000 lb per hr to the two turbines operating very near their maximum load. Thus during annual overhaul of the boilers the power station can still operate as a base-load plant.

General Layout

The plant is located at the Awirs on the river Meuse ten miles upstream from Liége and near the coal mines.

The ground between the river and the highway is 495 meters (1650 ft) long and 160 meters (530 ft) wide at the most. It was thus natural to have boilers, turbines and other buildings parallel to the river. The main building containing the two turbine-generators and the four boilers is 82 meters (270 ft) long and will be extended in the future to a length of 210 meters (690 ft). It is of reinforced concrete construction with pile foundations driven down to the gravel. The boiler room located between the pulverizing plant and turbine room is a very light steel structure with aluminum roof. There is no wall between turbine and boiler room but the pulverizing plant and ash hoppers are sealed off from the rest of the plant.

North of the main building is the transformer yard containing both step-up and auxiliary transformers and further north, is the auxiliary building with substations for auxiliaries on the ground floor, control rooms on the second floor and offices on the third floor.

East of the main building stands the workshop and spare stores and near the boiler room the coal-handling plant, further east is the coal yard.

At the western extremity of the ground are the circulating water screens, chlorinating plant, and water softening plant, as well as the 70-kv substation.

The railway yard with junction to the railroad as well as the ash plant are north of the highway.

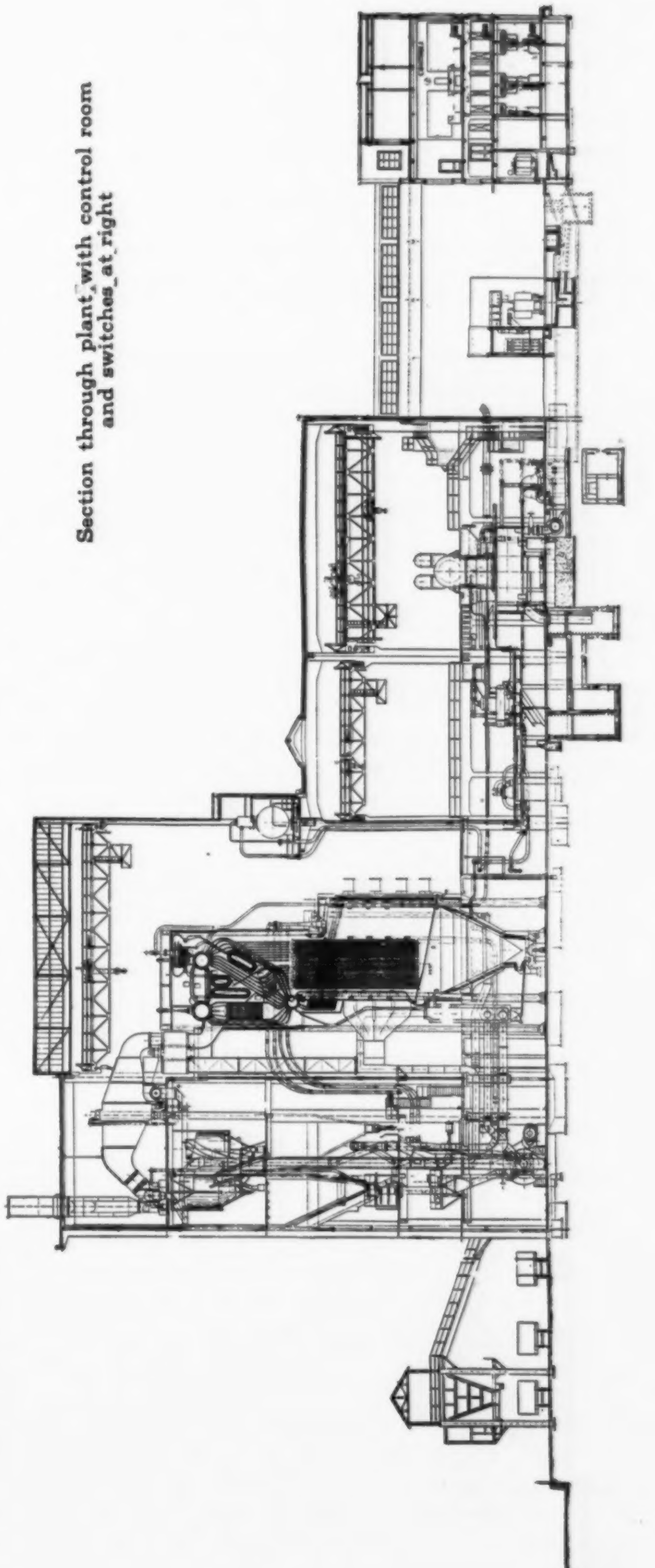
Boilers

The boilers are fired with pulverized coal employing the bin-and-feeder system which is well adapted to the low-volatile, high-ash coals which are pulverized in tube mills of 18 tons capacity. Moisture content is 6 per cent.

Steam is produced at 67 kg/cm² (950 psig) and 500 C (932 F) at the superheater outlet. Each boiler is rated at 200,000 lb per hr for best efficiency, 270,000 lb per hr for maximum continuous output and 290,000 lb maximum for two hours. The efficiency for nominal rating is 88 per cent with coal containing 35 per cent ash.

There are eight vertical burners in the roof of each furnace which has water tubes on three sides only and a dry-ash hopper. The highest calculated exit-gas temperature at the furnace outlet is 1150 C (2100 F) and heat release does not exceed 120,000 cal per cm (13,000 Btu per cu ft). The three-drum natural-circulation boilers, built by John Cockerill, each have a convection heating surface of approximately 15,000 sq ft. The low-temperature mild-steel superheater section and the high-temperature Cr-Mo superheater, have a total area of 17,300 sq ft.

Two bent-tube economizers each of 6000 sq ft heating



Section through plant, with control room and switches at right

surface heat the feedwater to 208 C (406 F), and two Ljungström regenerative air heaters raise the temperature of the forced-draft air up to 270 C (515 F).

The wet-type dust-collector has an efficiency of 97 per cent.

On each boiler two forced-draft and two induced-draft fans are driven by 6,300-volt squirrel-cage motors through variable-speed hydraulic couplings.

Turbine-Generators

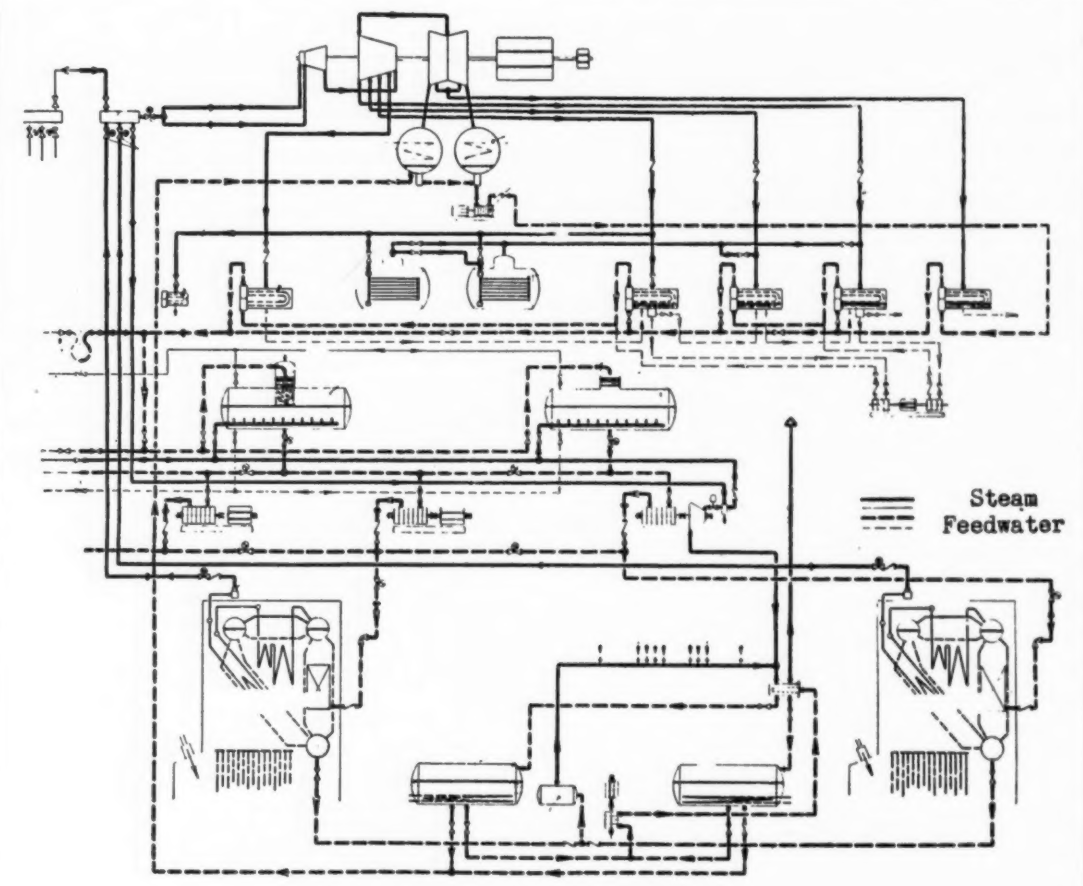
The Brown Boveri turbines are 3,000-rpm, 50,000-kw condensing machines designed for best efficiency at 35,000 kw at which load the heat rate is 2397 cal per kwhr (9588 Btu) delivered at the generator terminals. Each rotor has a Curtis wheel and 25 reaction stages in the high-pressure section, 20 stages in the intermediate and 5 in the double-flow low-pressure sections. Live steam conditions at the throttle are 860 psig and 900 to 930 F, with one inch back pressure. Brown Boveri's general practice is to counterbalance the thrust of the high- and medium-pressure bladings and design for opposite flows in the low-pressure section.

The air-cooled generators were built by Ateliers de Construction Electrique de Charleroi and rated at 50,000 kw, 0.80 pf, 62,500 kva, 10,500 volts, 3-phase, 50 cycles. Four water air coolers are provided for each unit. Connection is to the 70,000-volt bus by a step-up 60,000-kva transformer without tap-changer. The generators are designed to produce 62,500-kva each with voltage variations from 9000 to 11,200.

Condensing Equipment

Each machine has two single-pass 1800-sq meters (20,000 sq ft) vertical condensers with divided water boxes to allow cleaning one-half of each condenser during turbine operation.

The two circulating water pumps operating together deliver 1100 cmh (4000 gpm) with a total head of 6 meters (approximately 20 ft). One circulating water pump alone will allow carrying 60 to 70 per cent of full load on the turbine when the river temperature is 59 F.



Flow diagram for steam and water

Vacuum is maintained by a water ejector for normal operation and a steam ejector is provided to evacuate the condensers rapidly while starting up.

Water is taken from the river Meuse at the west end of the plant through two traveling water screens and flows through an underground tunnel to the turbine room after preliminary chlorination. A bypass line allows warm water from the condenser discharge to be mixed with cold water to maintain the best efficiency of the machine when the intake water is very cold.

Feedwater Cycle

Steam is extracted from the turbine at five points for

feedwater heating. All heaters are of the closed, horizontal, two-pass type. A 350-hp condensate pump handles water from the condenser hot well and delivers through all the heaters to the deaerator: which, with two large water tanks, has a capacity of 25,000 gal, enough for half an hour of full-load operation.

To minimize cascading losses of the condensate, two condensate pumps are operated. All of the heaters have shutoff valves and bypasses in the feedwater piping to allow for the inspection and repair of any heater. The two evaporators are capable of evaporating 5 per cent makeup. They are of the horizontal submerged-tube design and fed with bleed steam. Under normal conditions they operate with double effect, but can be connected in parallel in case of abnormal makeup water needs. Normal makeup averages about one per cent with steam soot blowers.

The river water containing hardness up to 300 parts per million is treated first by a decarbonization softener and then by a zeolite base-exchanger before being evaporated. The concentration of solid matters in the water within the evaporator shell is controlled by continuous blowdown. Trisodium phosphate is added in the feedwater to control pH. A small amount of sulfite is also added to control any residual oxygen remaining after deaeration.

Each 50,000-kw unit is equipped with two boiler feed pumps, (one motor- and the other turbine-driven) each capable of meeting full load. An identical motor-driven feed pump is provided for operation during overhaul of any of the other motor-driven pumps. The turbine-driven pumps are operated only as a standby in case of auxiliary power failure.

All five pumps are identical and run at 3000 rpm. They are of 8-stage, balanced-thrust, horizontal-joint, Worthington make, rated at 1000 gpm at 1190 psig outlet pressure with a positive suction head of 66 ft. The motors are each of 1000 hp, and of the General Electric direct-starting squirrel-cage type operating at 3000 rpm 50 cycles, 6,300 volts.

Coal Handling

Normally the power station uses so-called "secondary" coals from the Liége district whose ash content is high. The daily need runs from 1000 to 1200 tons, which supply comes from many collieries whose coals have various qualities. However, as it was considered necessary to deliver to the boilers a fairly constant quality coal, the coal-handling and conditioning plant is rather extensive. From nearby pits, coal comes mostly by truck, although a trackyard with two junctions to the railroad line of Liége-Namur was established to the north of the highway. Trucks are handled by a diesel-electric locomotive to the unloading plant located near and to the east of the boiler-house. After being weighed the trucks are handled in a car tipper capable of tipping ten 25-ton trucks to 45° hourly.

As some of the coal may occasionally be shipped to the plant by water an overhead grab crane is also provided for unloading the lighters at the rate of 50 tons per hour.

Chain conveyors and tippling bucket conveyors can handle 150 tons per hour and deliver coal to eight bunkers. Table distributors and chain conveyors mix the different coals to a constant quality necessary to obtain efficient combustion, the normal average mixture being coal with 5 per cent moisture 10 to 12 per cent volatile and 35 per cent ash.

A magnetic pulley separates tramp iron from the coal ahead of the belt conveyor which carries it to the boiler bunkers. This belt conveyor has automatic distributors to trip the coal into the boiler bunkers which have a capacity of 860 tons for each of the two units.

Yard storage is by means of a Beaumont scraper of 100 tons per hour capacity. The initial storage area is 330 by 260 ft and holds 40,000 tons of coal.

Operation of all the conveyors and of the scraper is concentrated in a central control room with signal and operating board. Interlocking prevents any piling up between conveyors. To minimize dust nuisance, tripping of the coal trucks is carried out in a totally enclosed place having automatic gates and efficient ventilation. All chutes are also equipped with dust aspiration. Dust collectors gather the coal dust which is then mixed with the unloaded coal.

Table distributors in coal plant

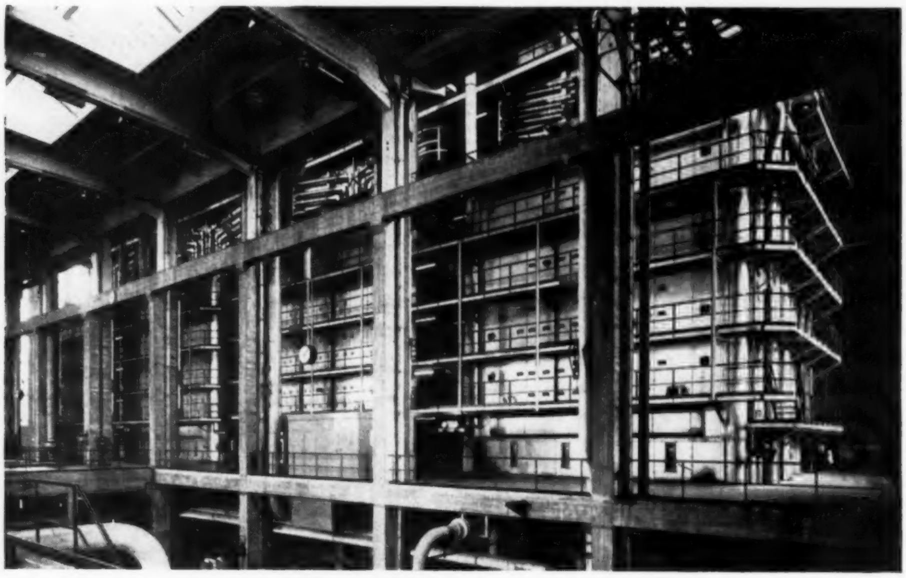
Ash Handling

Because of the character of the coal used, disposal of ash and grit is most important. Of the 300 to 400 tons daily some 15 to 20 per cent is dry ash from the furnace hoppers which is conveyed by belt conveyors to track hoppers which in turn deliver it to the ash pit. From 80 to 85 per cent of the ash in the coal burned is collected by a Modave wet-type collector, the effluent from which contains 4 per cent solid matter. This effluent gravitates through cast-iron pipes to two 66-ft diameter clarifiers from which the clearwater is returned to the river. The concentrated sludge is pumped by three diaphragm pumps to vacuum rotary filters. Since the dry cake contains only about 25 per cent water it is easy to handle.

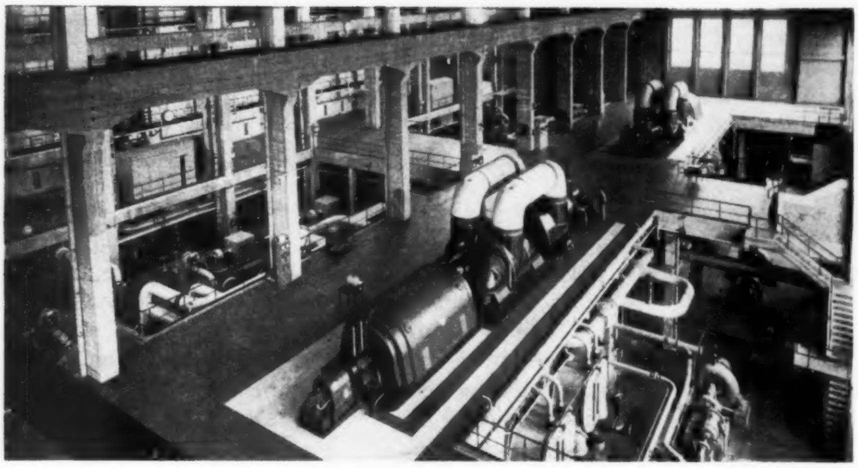
A cableway plant more than a mile long carries the ash and dry cake to a dump where it is spread by means of a bulldozer. This dump will be planted to avoid dust during dry weather.

Electrical System.

As mentioned previously the 10.5-kv generator voltage is stepped up directly to the 70 kv transmission voltage. Connections between generator terminals and the generator step-up transformer are through busbars. The 60,000 kva step-up transformer is of the shell

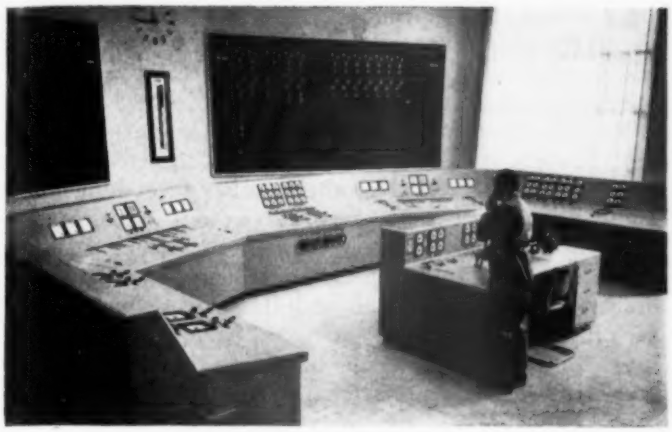


Boilers at operating level

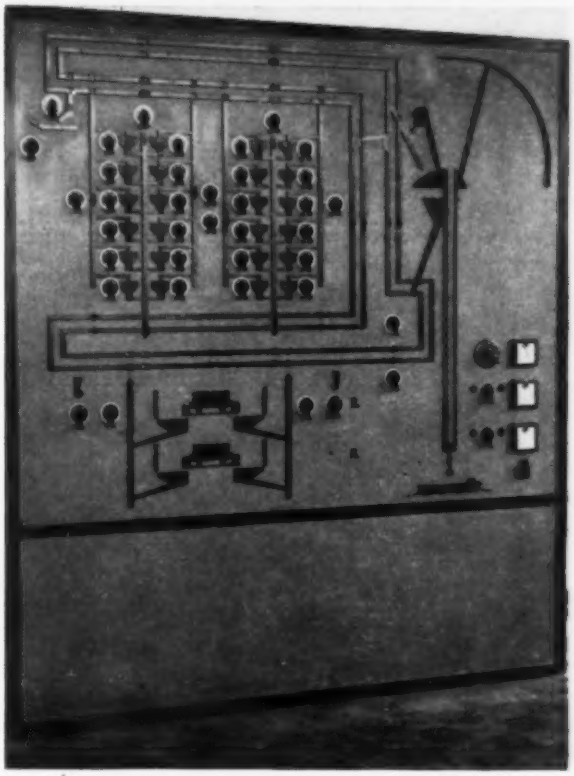


The turbine room has two 50,000-kw. units

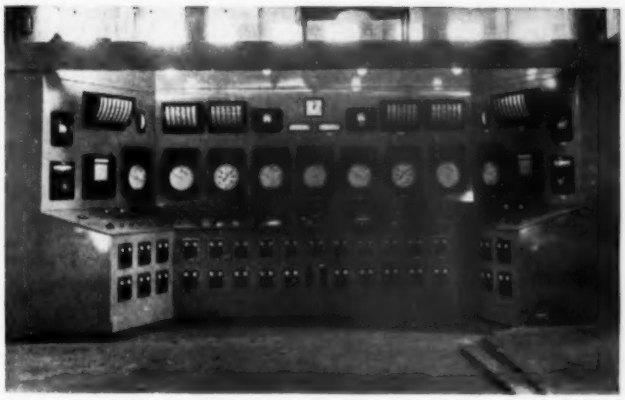
Heaters and boiler feed pumps



Control room



Operating panel in the coal plant



Boiler control panel

Vacuum rotary filters for sludge

Clarifier

type with natural ventilation up to 45,000 kva and forced-draft ventilation above this.

Connections between the high-voltage terminals of the transformer and the 70-kv substation is by compound-filled cables (two per phase).

Normal auxiliary power is obtained from a 5000-kva unit-transformer supplied at the generator terminals. A disconnecting switch at generator voltage allows operation while examining the transformer. An on-load tapchanger with automatic regulation takes care of the voltage variation of the generator while delivering constant voltage to the auxiliaries.

A house transformer used for starting of any unit is supplied from the 70-kv substation. A 5000-kva stand-by emergency transformer is connected to a 15-kv cable network. All these transformers are located in a yard to the north of the turbine room and separated against fire risk by concrete walls. An automatic sprinkler system is also installed.

Auxiliary motors of 130 hp and over the supplied at 6300 volts, whereas smaller auxiliaries are operated at 380 volts. Lighting is at 220 volts.

The essential auxiliaries supplied by the unit-transformer are so arranged that in case of failure they are automatically switched on the house transformer. The switchgear of house auxiliaries and of the two unit auxiliaries is located on the ground floor of the office building. The switchgear is of the open-air type with air-blast breakers operated from the different control boards.

The generator step-up transformers and the main house transformer are connected to the busbars of the 70-kv substation together with seven out-going transmission lines and also a 70/150-kv transformer interconnecting the power station with the 150-kv network of "Union Générale Belge d'Electricité".

With ground space limited, the 70-kv substation is of the enclosed type with two buses, one of which can be used as a transfer bus to allow overhaul of any circuit-breaker.

Control

Located on the first floor of the office building, the control room is well isolated from noise and heat, and living conditions are such that supervision and control can be most effective.

It was deemed useful to place the boiler control panels close to the boilers because of the complexity of controlling the burning of the secondary coals. Nevertheless, boiler pressure and steam pressure at the turbine throttle are indicated and recorded in the main control room. All auxiliary equipment, such as relay panels, recorders and meters are in a nearby room.

The control room contains two luminous signal glass panels, the electrical benchboard and a central desk. The glass panels have single line diagrams to indicate the position of switchgear, the live circuits (red) and dead circuits (green), and to signal the opening or closing of circuit-breakers with oscillating light as well as the operation of any relay. One of these panels, in front of the corresponding benchboard, concerns the 70-kv and 150-kv substation diagrams. The other panel deals with the auxiliaries.

The benchboard is horseshoe shaped and contains, in the center, the generator panels with the usual indicators for generators and excitation control. On the left and right of this desk, in front of the corresponding luminous panel, a mimic bus permits selection of any equipment and connection by relays to one of the two sets of operating manual controllers (one spare).

Each boiler control board, one for two boilers, contains a vertical panel, the draft gages, the steam pressure and temperature recorders, water-level indicator, and steam and water-flow recorders as well as the master control of the Bailey automatic boiler control. On the bench are the motor manual controllers with lights to indicate any disconnection and the ampere meters for each high voltage motor.

On the vertical face of the bench are the Bailey relays and controllers. The automatic boiler control is pneumatically operated and holds the steam flow-air flow ratio, the steam pressure and furnace draft at designed values. Coal flow is regulated by the variable drive of the pulverized coal feeders. The forced- and induced-draft fans are controlled through fluid couplings.

Future Units

The ultimate development of the Awirs power station is expected to reach 300,000 kw wih six units. In the future, technical progress will probably call for higher steam conditions or larger units. It has been foreseen already, and it will be possible without changing the general layout of the main building to install 50,000 kw units with one 450,000-lb per hr. boiler or 100,000 kw units with two boilers each. The general layout with independent units gives a free hand for the future.

*Series Dust-Collector Installations on Large Pulverized Coal Boilers**

Factual data covering experience, performance, capital expenditures and operating costs involved with series mechanical and electrostatic dust-collection installations at the Buzzard Point and Potomac River steam-electric generating stations serving Washington, D. C.

L. W. CADWALLADER

Gen. Supt. of Generating Stations

Potomac Electric Power Co.

DUE to the ever increasing importance of reducing the quantity of solid particles discharged into the atmosphere from smokestacks everywhere in this country, it has become increasingly necessary in many locations to install modern dust collector equipment. This is particularly true in the City of Washington, D. C. which, aside from being the Capitol of the Nation, is inherently an unusually clean city due to its lack of heavy industry. For this reason, the City of Washington is very conscious of any smoke or dust nuisance and, in fact, one of the provisions of the local smoke ordinance is essentially that any solid or gaseous discharge constituting a nuisance is unlawful.

Therefore, it has been necessary for the Potomac Electric Power Company, serving the District of Columbia and adjacent areas in Maryland and Virginia, constituting the metropolitan area of greater Washington, to install in its steam generating stations the most efficient and reliable dust collector equipment available. This can be more readily understood when it is pointed out that all three steam stations comprising the power company's generating facilities are located within a five mile radius of the Capitol.

The first pulverized-coal-fired boilers on the Potomac Electric Power Company system were installed in the Buzzard Point Station in 1933, at which time what was considered a far-sighted policy was adopted and electrostatic precipitators, three sections deep, were provided for each of the 375,000-lb per hr boilers installed at that time. These precipitators, installed on two boilers in 1933, had concrete-plate collecting electrodes, chain scrapers for cleaning the collecting plates and were guaranteed to collect 95 per cent of suspended matter in the flue gas at a rated gas capacity of 186,000 cfm and about 345 F. This was the first electric utility installation in the country to have such elaborate electrostatic precipitator equipment. The effectiveness of this design is indicated by the fact that, to date, there have been no repairs to the wheels or casings of the induced-draft fans serving these boilers. Similar equipment, except for such modifications as were dictated by advancements in design, was installed on four additional boilers which were placed in operation in this station in 1940, 1942, 1943 and 1945. Each of these four boilers is rated at 525,000 lb per hr.

Despite this progressive planning, our neighbors ad-

* Presented at the 45th Annual Convention of the Air Pollution and Smoke Prevention Association of America, Cleveland, Ohio, June 9–12, 1952.

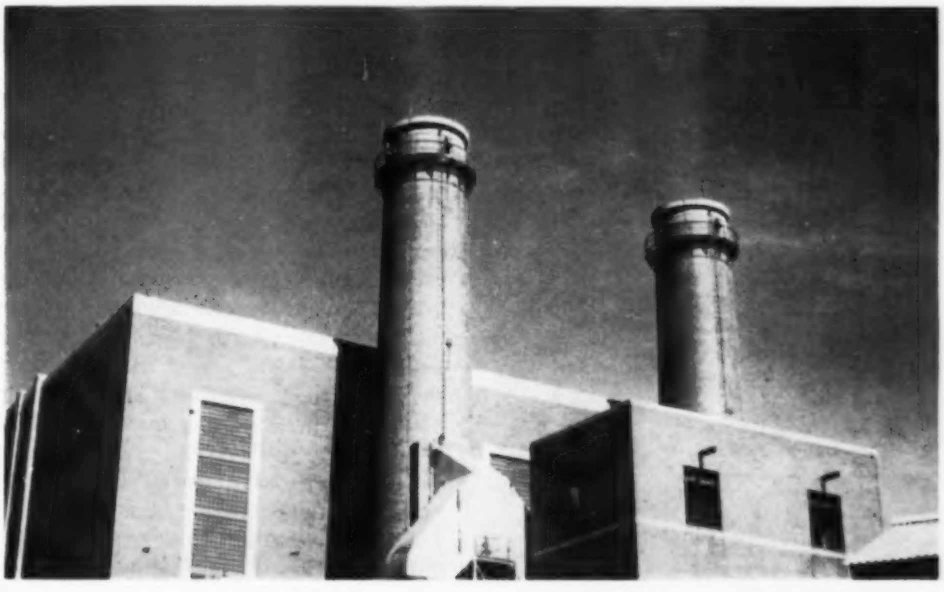


Photo by F. T. Sobeck

Appearance of Potomac River Station stacks at full load on both units

jacent to the station became increasingly unhappy over the stack discharge. While the appearance of the stacks was good, the results from a public relations standpoint were not so good. The entire situation was aggravated by the poor grade of coal that had to be burned during World War II years. The electrostatic precipitators did not do a good job of collecting carbon particles present in the fly ash; the efficiency of the precipitators decreased with the higher percentage of ash in the coal and there was consequent higher dust loading of the gases entering the precipitator. There was also a discharge of agglomerated ash from the stacks. These agglomerates consisted of fine particles of ash held together by an electrostatic charge and they had the characteristic of falling adjacent to the plant. When these falling agglomerates struck something solid they splashed much like a raindrop, and when they splattered automobiles or boats, the appearance was not pleasing.

As a result, a careful study was made of the situation and the decision was reached in 1948 to find some way of installing mechanical collectors in series with the precipitators. After much engineering effort, a design was developed with one of the well-known manufacturers of mechanical collectors which replaced the duct-work between the precipitator outlet and the induced-draft fan inlet. This arrangement placed the mechanical collectors "after" the electrostatic precipitators. The installation of mechanical collectors on all six boilers at the Buzzard Point Station was completed in 1951.

The results have been gratifying. While advantage had previously been taken of the night hours to cover most of the soot blowing and precipitator cleaning periods—which procedure is no secret to power plant operators or smoke inspectors—since the installation of the mechanical collectors, soot has been blown and precipitators cleaned on a regular schedule night and day. We can honestly report that since the mechanical collectors were placed in operation in series with the electrostatic precipitator, we have not received a single complaint on stack emission. It is believed that H. K. Kugel, Chief, Engineer of Smoke Regulation and Boiler Inspection of the District of Columbia, will be glad to confirm this statement.

Our new Potomac River Station, which was designed and built after the close of World War II, consists of two 800,000-lb per hr boilers placed in operation in 1949 and 1950. After all design work had been practically completed, it became necessary to install mechanical collectors in series with the electrostatic precipitator because of a severe reduction in stack height caused by proximity of Washington National Airport. In this case, the only possible location was between the air heater outlet and the precipitator inlet, which placed the mechanical collector "before" the precipitator.

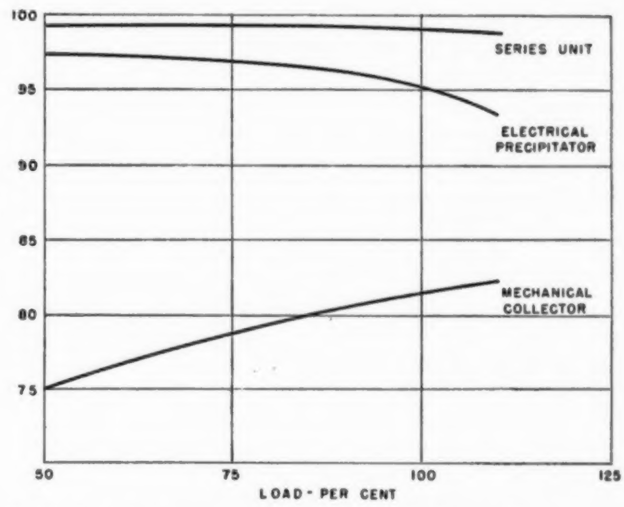
DUST-COLLECTOR TEST DATA, POTOMAC ELECTRIC POWER CO.

	Buzzard Point Station Mechanical	Buzzard Point Station Electrical	Potomac River Station Mechanical	Potomac River Station Electrical
Boiler output, lb steam per hr	464,000	430,000	658,000	690,000
Coal burned, tons per hr	20.08	19.60	28.85	30.26
Gas volume through collector, cfm	215,000	240,000	319,800	297,700
Gas temperature, F	312	295	315	354
Draft loss across collector, in. H_2O	1.8	0.5	1.2	0.4
Gas velocity, fps		8.6		7.1
Treatment time, seconds		2.2		2.5
Inlet dust loading, grains per cu ft	0.452*	1.70*	1.846*	1.22*
Outlet dust loading, grains per cu ft	0.083*	0.127*	0.416*	0.062*
Test efficiency, per cent	81.6	92.5	77.5	95.0
Guaranteed efficiency, per cent	80.8†	95.0	78.7†	95.0
Calculated overall efficiency, per cent	98.52		98.88	

* Adjusted to standard conditions of 32 F and 29.92 in. Hg
† Corrected for variation in particle size from guarantee

The preceding tabulation, Dust Collector Test Data, indicates the test results obtained from these installations. At neither station was it possible to test simultaneously the mechanical collector and the electrostatic precipitator. They were furnished by different manufacturers, each of whom has it own established test procedure. Furthermore, due to space limitations, it was not possible for both manufacturers to take gas samples simultaneously at the common duct between the mechanical and electrical collectors.

There have been some expressions of opinion in favor of installing more liberally designed electrostatic precipitators with lower gas velocity and longer treatment time in order to improve performance. This design requires gas velocities in the order of 5 fps which in some instances results in the width of the straight electrical precipitator being greater than that of the boiler and its side aisles. This introduces not only the problem of available space but also the problem of uniform gas distribution.



Typical performance curves for fly-ash dust collectors

The series dust collector appears to be particularly well adapted to the requirement of optimum efficiency of fly-ash collection on large pulverized-coal-fired units. The attached graph indicates typical performance curves for fly-ash dust collectors. It will be noted that the efficiency of a mechanical collector increases with load whereas the efficiency of an electrostatic precipitator decreases with load. The combination of these two types of equipment into a series unit results in a sustained high collection efficiency throughout a wide range of load, including maximum load which is a most important consideration. We are continuing with the installation of series dust collectors on all new additions to our steam generating facilities.

This decision, of course, raises the much argued question of whether the mechanical collector should be located "before" or "after" the electrostatic precipitator. It was our best judgment that the mechanical collector

should be located "before" the electrical. However, in both instances discussed above, the final decision in this matter was dictated by the space available to accommodate the equipment, with the result that the mechanical collector is situated "before" the electrical at Potomac River Station and "after" the electrical at Buzzard Point Station. Of the two installations, the stacks at Potomac River Station present the most pleasing appearance.

Tests indicate that when blowing soot and cleaning precipitator plates there is somewhat less effect on stack emission at Potomac River Plant where the mechanical collector is located "before" the electrical. In our new installations, where there is some freedom of action in the early stages of design, we have elected to install the mechanical before the electrostatic precipitator.

The very substantial capital expenditures required to provide these facilities in a large generating station are not always fully appreciated. In addition to the direct cost of the collector equipment, there is the expense of providing fly-ash handling systems including storage tanks and dustless unloaders. Actual capital expenditures for the equipment installed in the two stations described was as follows:

	Buzzard Point	Potomac River
Number of boilers	6	2
Station capacity (nameplate)	270,000 kw	160,000 kw
Type of furnace bottom	Slag tap	Dry bottom
Per cent of ash collected in furnace bottom	25	10
Electrostatic precipitators	$558,310	$434,000
Mechanical collectors	$488,500	$216,000
Fly-ash handling system, storage tanks and unloaders	$311,430	$210,500
Total	$1,358,240	$860,500
Per cent of total station cost	5.81	3.67
Cost per kilowatt of nameplate rating	$5.02	$5 38

The above tabulation indicates that a capital expenditure of approximately $5.00 per nameplate kilowatt is required to provide efficient series dust-collector installations with necessary auxiliary equipment on large pulverized-coal-fired boilers. This cost would be increased substantially in cases where changes to the building, foundations or structural steel are required to accommodate the fly-ash collectors and the additional loads imposed by them.

In addition to the capital cost there are also the operating and maintenance costs which, for the two stations described, are as follows:

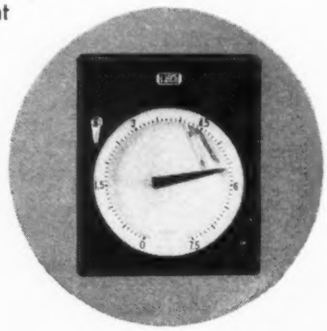
	Buzzard Point		Potomac River	
Year	1950	1951	1950	1951
Coal burned, net tons	482,083	507,574	316,912	448,184
Fly ash handled, cu yd	38,280	42,745	36,694	46,616
Operating cost per cu yd including hauling and disposal	$0.85	$0.81	$0.73	$0.62
Maintenance costs (labor and material) per cu yd	$0.46	$0.50	$0.12	$0.22

Many other electric utilities have approached this problem in a progressive manner and have expended substantial sums of money to do their part in reducing atmospheric pollution in the communities which they serve. Local smoke officials have exhibited a friendly understanding of the problems involved. This has certainly been the case in Washington where Mr. Kugel has been most cooperative and helpful. In this spirit of understanding and cooperativeness we can all rest assured that rapid progress will continue to be made by the electric utility industry in the elimination of the smoke and fly-ash nuisance.

Measures fundamental indicator of combustion efficiency—Oxygen. Applicable to power plants and process problems like catalytic crackers, open hearths, process heaters, inert gases, etc.

PRINCIPLE — Based on paramagnetic (attracted by magnetism) properties of Oxygen.

FEATURES — Highly sensitive to change in O_2 content — responds rapidly. Electrically operated. Electronic type recorder. Temperature controlled. Pressure compensated. No liquid or gaseous fuel required. No chemicals. Highly accurate. Not affected by wide change of gas flow rate. Continuous sampling and recording. Glass and corrosive resistant sampling system. Remote mounted analyzer and recorder. Four records on same chart possible. Low maintenance.

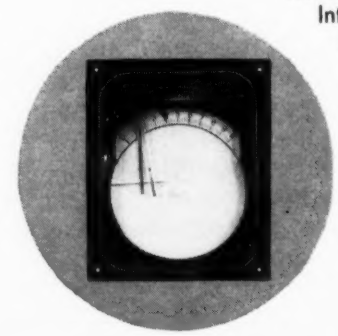


Hays Magnotherm O_2 Meter

Provides a *QUANTITATIVE* guide to efficiency — deals with quantities of air and steam; by contrast CO_2 and O_2 meters are *QUALITATIVE* guides since they determine directly quality of combustion gases.

PRINCIPLE — Record of steam flow is assumed to be Btu's produced; record of air flow is calibrated to flow of air required to generate that steam.

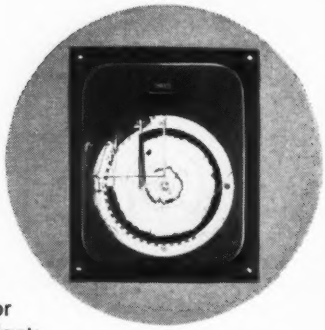
FEATURES — Electric operation of flow meter and air flow recorder. Diaphragm-type air flow measuring unit. Air flow measuring element does no work. Air flow recorder—motor operated. Adjustable cam air flow calibration. Mercury transmitter — pressures to 2500 psi. Interchangeable range tubes for steam flow. Remote mounted steam flow transmitter. No high pressure piping into panel. Easily installed and adjusted. Low maintenance.



Hays-Penn Boiler Efficiency Meter

Which combustion guide is best?

IT DEPENDS . . . on the fuel you're burning, the accuracy you require, the price you want to pay, etc. Your particular needs will determine your choice . . . but remember—only Hays can supply you *without bias* . . . because only Hays has a *complete* line of Combustion Guides.

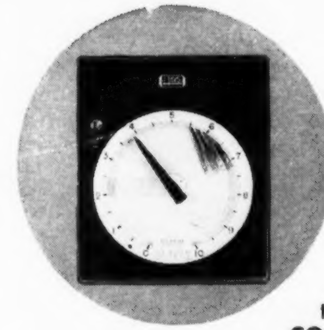


Hays Combustion Meter

Hundreds of these meters have been in operation for many years in all types of plants burning all kinds of fuels and saving thousands of fuel dollars.

PRINCIPLE — Operates on Orsat principle of volumetric measurement and chemical absorption. Difference in sample before and after absorption gives exact percentage of CO_2 absorbed by chemical.

FEATURES — Low price. Water operation. Pressure and temperature compensated. Volumetric determination. Chemical absorption. 2-minute operating cycle. Easily understood. Rugged construction. Low maintenance. Available in 6 remote mounted types and 3 integral types: (a) CO_2 only—recording with or without indicator (b) CO_2 and flue gas temp. recorder combined (c) CO_2, draft or flue gas temp. recorder combined. Remote or integral mounting.



Hays Condu-Therm CO_2 Meter

A *new* instrument using three *established* ideas: (1) CO_2 as guide to combustion efficiency (2) thermal conductivity principle (3) electronic type operation.

PRINCIPLE — Based on thermal conductivity of gases, i.e., that all gases conduct heat at different rates.

FEATURES — 5-second response to change in CO_2 content. $\pm$ .25% accuracy for ranges 0 to 20%. Electrically operated. Electronic type recorder. Temperature controlled. Humidity controlled. No chemicals required. No moving parts in analyzer. Continuous sampling. No drying agent required. Unmatched construction features. Not affected by wide change in gas flow rate. High sensitivity. Rapid response. Continuous recording. Remote mounted analyzer and recorder. Low maintenance.

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Handling Material for the Walter C. Beckjord Station

By RAYMOND F. SCHIERLAND†

Excerpts from a paper presented at the ASME Semi-Annual Meeting in Cincinnati, June 15–19, describing how the heavy equipment for this new station, which has no railroad connection, was delivered by rail to cranes at the Miami Fort plant, 38 miles downstream, and brought by barge to the Beckjord Station.

THE Walter C. Beckjord Station is the most recent addition to generating facilities of the Cincinnati Gas & Electric Company. The first unit, recently placed in service,[1] is rated 100,000 kw. The second, to go into service in June 1953, is the same size, and the third, scheduled for operation in December 1954 will be of 125,000 kw. All unit installations are of the single-boiler type with steam conditions of 1450 psig, 1000 F, 1000 F reheat.

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† Assistant Mechanical Engineer, General Engineering Department, The Cincinnati Gas & Electric Co.

[1] See COMBUSTION, July 1952, page 45.

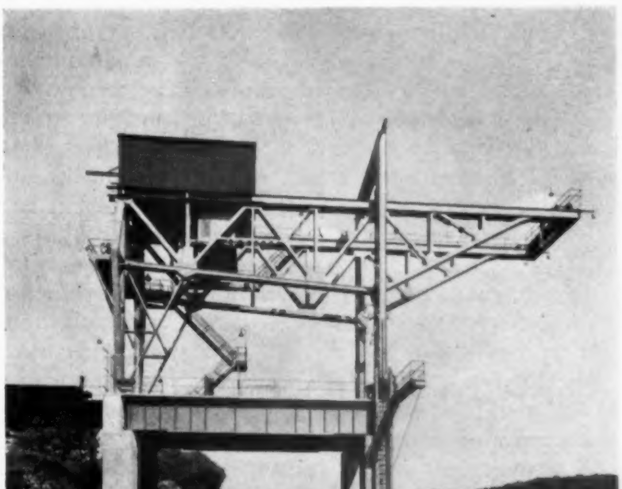

Fig. 1—Miami Fort Station crane

The site, about eighteen miles upstream from Cincinnati, has the disadvantage of not being near a railroad. Early investigation indicated that the cost of building trackage to connect with the nearest railroad, about 11 miles away, would be nearly $3,000,000. The high cost was due to the necessity of such a connection crossing several state and county roads, and requiring a long, high-level viaduct across a river.

The only remaining alternative was to use river barges for delivery of heavy equipment. Investigation revealed however, that over the entire navigable length of the Ohio River, there were no crane facilities capable of handling the heaviest loads. Furthermore, handling of many lighter items which could not be trucked to the site because of their physical size, would have been unduly devious and expensive through facilities owned by others. It was therefore decided that the Cincinnati Gas & Electric Company would install materials handling cranes on its own properties, and purchase barge equipment suitable for heaviest loads.

Miami Fort Station Receiving Area

The Company's Miami Fort Station, located 20 river miles downstream from Cincinnati, has a spur from the Baltimore & Ohio R.R., and was chosen as the railhead for the Walter C. Beckjord Station rail-river shipping system. Ample land was available adjoining the river for the barge-loading crane structure, track approach and barge anchorages. This station site had the advantage of providing adequate storage area for receiving and holding materials until needed at the new station. In addition, since Miami Fort Station receives all its coal by river barge, empty hopper-bottom barges are always available for upriver movement of relatively light items which cannot be handled conveniently on the Company's own special reinforced flat-top cargo barges.

Crane Design

In determining the capacity of the cranes to be installed, careful consideration had to be given to the possible size of future units at the new station. The decision was made to provide capacity to handle fully assembled generator stators (less rotors) one size larger than the initial units. If future units of much larger size are ultimately chosen, it will be necessary, of course, to arrange for incomplete factory assembly. However, recent new developments in generator cooling methods indicate that resultant weight reductions will enable the cranes to handle stators of considerably higher rating than originally contemplated.

The original design of the cranes was 125 tons, with a 50 per cent overload rating, for a gross capacity of 187.5 tons. Subsequent minor revisions in design raised the capacity to a maximum of 207 tons. To avoid unduly

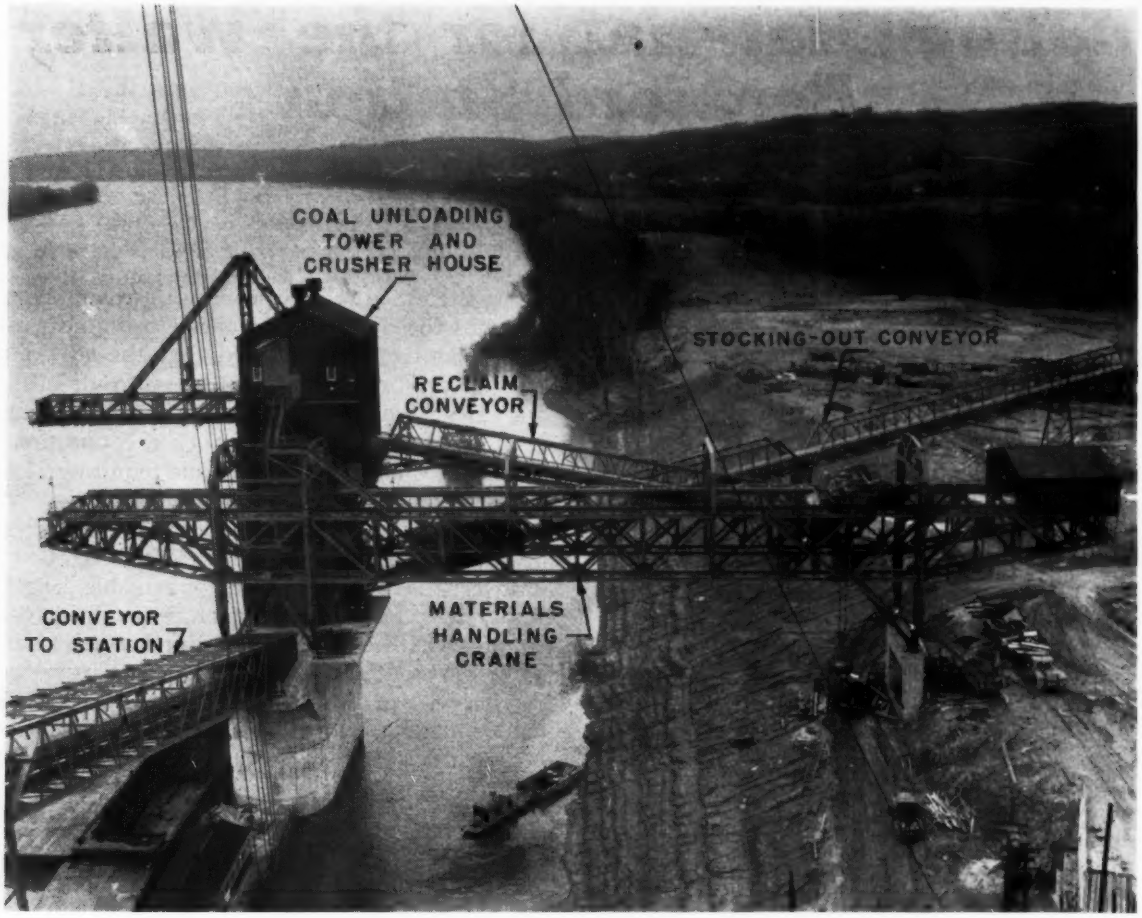

Fig. 2—Walter C. Beckjord Station crane

expensive cantilever structures, the design provides that this maximum load can be carried only to the longitudinal centerlines of barges on the river ends of both cranes and to the centerline of the transfer track on the land end of the Walter C. Beckjord Station crane.

At Miami Fort Station the railroad track is brought under the land end of the crane bridge on a steel beam concrete pier trestle, where the river bank drops away from the flood plain, shown in Fig. 1. Most of the crane trackage, connecting with the station trackage, is ballast type construction. The track has a slight downward grade toward the crane which facilitates movement of the heavier loads.

"Deadmen" consisting of large reinforced concrete blocks below ground level are strategically located for barge mooring lines. Two motor-driven capstans are located at the river end of the crane deck for barge shifting. An outrigger is installed on each side of the crane deck to serve the double purpose of providing necessary reach and angle for the barge shifting lines, and observation platforms. The two capstans are mounted as a single unit, and supplied through plug-in power cable fittings. During floods the capstans may be unbolted from the deck and lifted out of reach of water by use of the crane auxiliary hook.

At the Beckjord Station, a railroad track runs under the land end cantilever section, perpendicular to the longitudinal axis of the bridge, as shown in Fig. 2. South of the crane, the track has two branches. The east branch runs by the main power transformer positions. A special transformer transfer car is provided for handling this equipment. The west branch runs into the station turbine room unloading bay, where loads are handled by the turbine room crane. The turbine room crane, of the usual overhead traveling type, is nominally rated at 150 tons on the main hook, but is suitable for carrying the same maximum loads as the river cranes.

Loads are carried from the river crane to the turbine room unloading bay on a special steel deck car, owned by the Company, capable of carrying the maximum load which can be handled by the cranes. The car is moved with a four-wheeled, rubber-tired, diesel-engine tractor provided with a car coupler. The tractor is part of the station's complement of coal moving equipment, and normally draws a two-wheeled scraper. When it is to be used for car moving, the scraper is removed by use of an overhead crane in the tractor garage, and a cast iron ballast weight is installed to provide adequate traction.

While the bridge structures of the Beckjord and Miami Fort cranes differ greatly, the trolleys are identical.

The 207-ton hook on each crane has a maximum speed of 4 ft per min. An auxiliary hook is also provided, of a maximum capacity of 37.5 tons (25 tons nominal with 50 per cent overload rating) and a maximum speed of 27 ft per min. The auxiliary hook ratings were so chosen as to use the same size drive motor as the main hook, namely 75 hp. Use of duplicate trolleys at the two sites, and the same motor size throughout, minimizes spare parts requirements.

Trolley power is supplied at 440 v, 3-phase, the power and control being alternating current throughout.

To provide maximum comfort for operators, cabs are

Fig. 3—Loading boiler drum on barge at Miami Fort Station

completely insulated, heated and ventilated, and all windows are glazed with Thermopane.

Flood Conditions

On the Miami Fort Station crane, the elevation of the track deck was chosen to correspond approximately to the official "flood" level of the Ohio River in the Cincinnati area. Above this level, rail shipments are blocked, and river travel becomes too hazardous to warrant risk of loss of equipment. However, the crane cab and power supply transformers and lines are well out of the reach of even maximum floods. Heating units used to avoid deterioration of control equipment by moisture can therefore be kept energized whenever desired.

At Walter C. Beckjord Station, all operations, both inside the plant and in the yard, are protected to an elevation 5 ft above the maximum recorded flood. The latter, which occurred in 1937, reached a crest of 80 ft above gage zero at Cincinnati.

Illustration of Typical Heavy Loads

Figs. 3 and 4 illustrate the handling of some of the heavier elements entering into the project. Fig. 3 shows the main boiler drum, weighing nearly 90 tons, being moved. Operation with the heaviest single piece handled to date, the generator stator, weighing 187 tons, is shown in Fig. 4.

Conclusion

This material handling equipment, including both cranes and barges, has given complete satisfaction. A total of 130 railroad carloads of equipment weighing approximately 2820 tons were shipped by barge from Miami Fort Station. This equipment was handled in 20 barge loads. In addition, several barge loads of equipment shipped by vendors from upriver points, were unloaded at the Beckjord Station. No changes are contemplated in the procedure for future units.

Fig. 4—Generator stator on Walter C. Beckjord Station crane

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The Minimum Continuous Safe Flow of Centrifugal Pumps

A discussion of the minimum continuous safe flow and allowable temperature rise of the liquid being handled to avoid flashing, together with formulas and sets of curves to determine such values.

By E. C. CONDICT
De Laval Steam Turbine Co.

LIQUIDS in a centrifugal pump will flash into vapor when the capacity being pumped is too low. Knowing when this will happen and how to prevent it will enable operators to avoid such trouble.

Heat is generated whenever work is done. The work used by a pump to increase the pressure of the liquid makes it heat up. When the capacity is large enough to carry off most of this heat, the temperature of the liquid passing through the pump will rise only a few degrees. But at small flows the heat may not be carried away fast enough to prevent the temperature of the liquid from rising sufficiently to cause flashing into vapor.

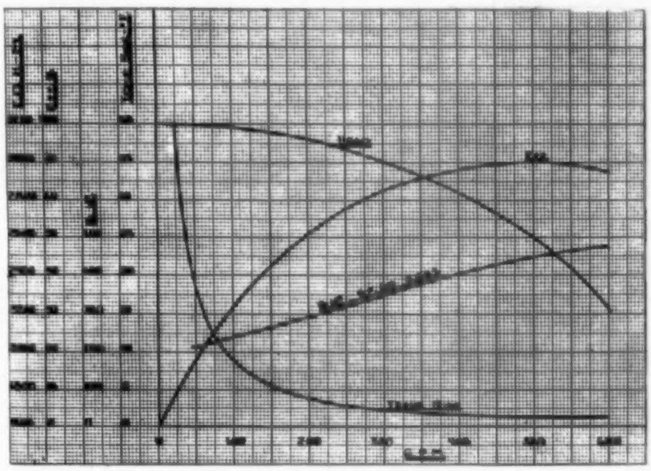


Fig. 1—Pump charcteristic curves

The smallest flow at which a centrifugal pump can be safely operated is called the *minimum continuous safe flow.* If it is run continuously at less than this amount, the liquid in the pump will flash.

The amount the temperature of the fluid can rise before flashing is known as the *allowable temperature rise.* Suction conditions determine *NPSH* (net positive suction head), expressed in feet of the liquid being pumped measured at the centerline of the pump. *NPSH* is the net head above the vapor pressure corresponding to the temperature of the liquid being handled.

The allowable temperature rise is found by converting the feet of available *NPSH* into pounds per square inch and adding this to the vapor pressure corresponding to the temperature of the liquid being pumped. This pressure is the vapor pressure corresponding to the temperature to which the liquid may be raised before it will flash. Once the allowable temperature rise has been established the minimum safe continuous flow can be calculated by the formula:

$$n = \frac{TDH \times 100}{778t + TDH} \qquad (a)$$

where n is the pump efficiency expressed as a percentage; *TDH* is the total dynamic head in feet; and t is the allowable temperature rise expressed in degrees F. The capacity corresponding to this efficiency is found on the pump characteristic curves.

The next problem is to select the correct *TDH*. At no flow the *TDH* is called shut-off pressure, or *SOP*. The head of a normal centrifugal pump rises constantly to the *SOP*. Therefore, if the *SOP* of a pump is substituted for *TDH* in formula (a), any error in calculating the efficiency will be on the safe side. Substituting *SOP* for *TDH* in the above formula gives:

$$n = \frac{SOP \times 100}{778t + SOP} \qquad (b)$$

The curves were developed to eliminate calculations for centrifugal pumps handling hot water by solving the problem graphically. Similar curves may be made for any liquid. For example, take the pump whose characteristics are shown in Fig. 1. The *SOP* is 3200 ft. Determine the minimum continuous safe flow when handling 220 F water with 19 ft *NPSH*. The curves in Fig. 3 show that the allowable temperature rise is 20 deg F., and that the efficiency corresponding to the minimum continuous safe flow is 17 percent. The capacity (see Fig. 1) corresponding to 17 percent is 47 gpm.

How can the pump whose characteristics are shown in Fig. 1 be protected from flashing? Install a bypass line having a suitable orifice from the discharge of the pump back to the suction heater. The size of the orifice is such that it will pass the minimum continuous safe flow. This bypass line cannot go back to the suction of the pump, as the same fluid would be handled over and over again, causing the temperature to rise until the liquid would flash.

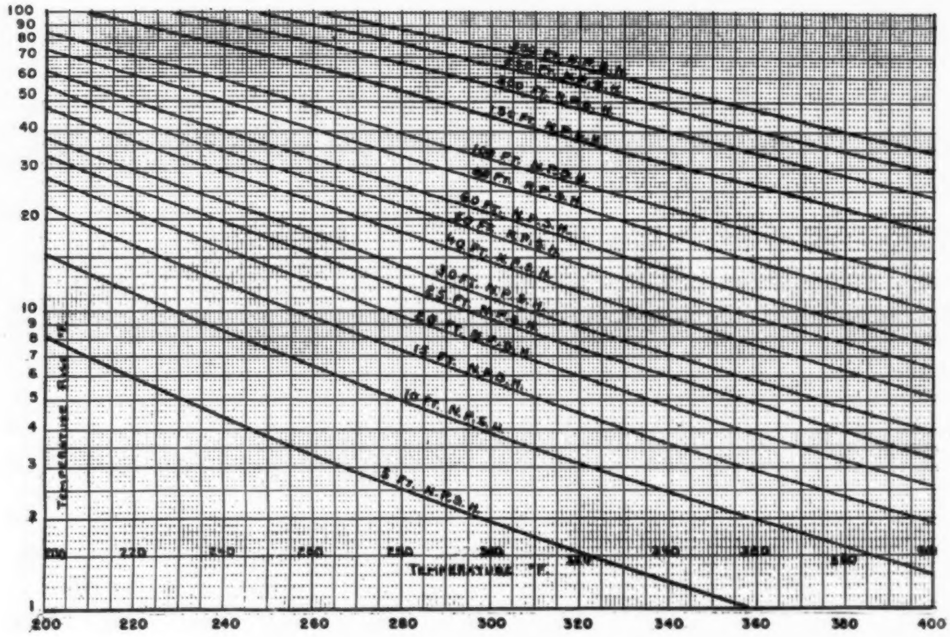


Fig. 2—Temperature rise curves

There are two fundamental ways of taking care of the bypass flow. One is to keep the bypass open at all times. In this case the rated capacity of the pump must be the rated capacity of the system plus the minimum continuous safe flow. The second method is to use some flow regulating device. When the pump capacity decreases and approaches the minimum continuous safe flow, a valve in the bypass line is opened. When the flow is above the minimum the valve is closed. This may be done either manually or automatically.

Curves shown in Fig. 2 may be used to determine the *NPSH* required for a new installation. Assume that a pump is to be installed for handling 275 F water. It is desirable to have a 15 deg F allowable temperature rise. This gives a safe margin for possible surges in the suction heater. The curve shows that 30 ft *NPSH* will be required. This means that the heater must be placed high enough above the centerline of the pump so that after friction and entrance losses have been subtracted from the static elevation, there is available 30 ft of liquid head over and above the vapor pressure.

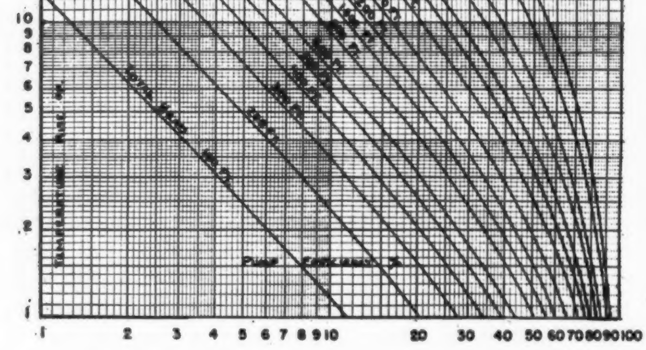


Fig. 3—Temperature rise vs. pump efficiency

When liquids other than water are being handled it would be necessary to draw temperature rise curves based upon the characteristics of the liquid being handled.

For mechanical reasons, such as unequal expansion of pump parts, it is desirable to limit the temperature rise. A maximum temperature rise not exceeding 30 deg F is good practice. However, it is advisable to consult the pump manufacturer. Some materials cannot be operated above a certain temperature regardless of the allowable temperature rise.

Knowing when and how to protect a centrifugal pump from overheating is very important. The curves here shown, or modifications suitable for the liquid being handled, enable an operator to know how to protect his pump from flashing.

Mechanical Engineers to Participate in CENTURY OF ENGINEERING

AS previously announced in these columns, the Century of Engineering which is being celebrated this year with numerous engineering society meetings in Chicago will culminate with a Convocation extending from September 3 through September 13. During this period sessions will be held on successive days devoted to various industries in which engineering plays an important role. An impressive program of addresses by prominent individuals has been scheduled. Among these will be the following:

Wednesday, September 3, Eighth Street Theater

The Role of the Organized Profession

"Background and Development of the American Society of Civil Engineers," by James K. Finch, Dean Emeritus, Columbia University

"Part Played by Military Engineers," by Col. M. Heiburg, West Point faculty

"Growth of the American Institute of Mining and Metallurgical Engineers" by A. B. Parsons, consulting engineer

"Advancements Made by The American Society of Mechanical Engineers" by George Stetson, editor, *Mechanical Engineering*

"Evolution of the American Institute of Electrical Engineers" by M. B. Hooven, Public Service Electric & Gas Co.

"The Story of the American Institute of Chemical Engineers" by Sidney D. Kirkpatrick, editorial director, *Chemical Engineering*

"The Inter-Society Role" by Harry S. Rogers, president, Polytechnic Institute of Brooklyn

Thursday, September 4, Eighth Street Theater

Education and Training, A. A. Potter, dean, Purdue University, chairman

"History of Engineering Education" by F. T. Mavis, Carnegie Institute of Technology

"Achievement to Date in Engineering Education" by Thorndike Saville, dean, New York University

"The Technical Institute: Its Relation to Engineering Education and to Trade Training" by C. W. Beese, dean, Purdue University

"The Engineer and the Scientist" by W. F. G. Swann, director, Bartol Research Foundation of Franklin Institute

"Looking Ahead for Engineering Education" by S. C. Hollister, Cornell University, and L. M. K. Boelter, University of California

Monday, September 8, Hotel Sherman Ballroom

Mineral Industries, Clyde Williams, Battelle Memorial Institute, chairman

"Exploration for Metals, Petroleum and Water" by William E. Wrather, director United States Geological Survey

"Coal—Mining, Preparation and Utilization" by J. B. Morrow, Alford, Morrow and Associates

"Synergism of Engineering and Petroleum" by Robert E. Wilson, chairman of the board, Standard Oil Co. (Indiana)

Thursday and Friday, September 11 and 12, Conrad Hilton Hotel

Energy Symposium, Eugene Ayres, Gulf Research and Development Co., chairman

"Demands for Energy" by Richard J. Lund, Battelle Memorial Institute

"Coal Reserves—A Matter of Economics" by Harold J. Rose, Bituminous Coal Research, Inc.

"Availability of Oil Products" by E. V. Murphree, president, Standard Oil Development Co.

"Supply of Water Power in the United States" by Frank M. Gunby, Charles T. Main, Inc.

"Steam and Electric Power—Its Past and Future" by Theodore Baumeister, Columbia University

"District Steam Heating" prepared by past presidents of the National District Heating Association and presented by A. R. Mumford, Combustion Engineering-Superheater, Inc.

"Warmth for Comfort" by Maria Telkes, Massachusetts Institute of Technology

"Conservation in Production of Oil and Gas" by William J. Murray, Jr., commissioner, Railroad Commission of Texas

Concurrently with the Convocation will be held the Fall Meeting of the American Society of Mechanical Engineers, from September 7 to 11. An extensive program involving 37 sessions and 97 papers has been prepared. Social activities begin on Sunday afternoon, September 7, when ASME members, guests and ladies are invited to a reception at the Edgewater Beach Hotel under the sponsorship of the Chicago Section of ASME.

A tour of the Museum of Science and Industry is scheduled for Tuesday afternoon at 5 p.m., to be followed by a dinner at the Museum and a special performance of the Centennial Pageant, "Adam to Atom." The latter is a fascinating dramatization of the historic American applications of invention and engineering skills that are responsible for the social and economic strength of the nation.

On Wednesday, September 10, ASME members will participate in the Centennial Luncheon, at which time the Fritz Medal will be presented to Benjamin F. Fairless, president of U. S. Steel Corp., and the Hoover Medal to Clarence D. Howe, Minister of Defense Production, Dominion of Canada. At the same luncheon, Allen Quartermain, president of the Institution of Civil Engineers, London, will have as his subject, "Tribute of the Engineering Profession to the American Society of Civil Engineers." The Centennial Party, to be held Wednesday evening, September 10, will feature an address by Charles F. Kettering of the General Motors Corp., chairman of the executive committee of the Centennial of Engineering.

The technical program of the ASME Fall Meeting includes these papers which are expected to be of particular interest to engineers in the power plant field:

Monday, September 8, 9:30 a.m.

"Steel Works Power Plants" by H. J. Bentson and R. W. Worley, United Engineers and Constructors, Inc.

"Operating Experiences With 1250 Gpm Demineralizer Water-Treatment Plant" by D. N. Purcell and Vincent B. Burgess, Philadelphia Electric Co.

12:15 p.m.

President's Luncheon

Speaker: R. J. S. Pigott, President of ASME

Subject: What Is Not Yet, May Be!

2:30 p.m.

"Industrial Applications of Nuclear Energy" by Alfonso Tammaro, Chicago Operations Office, Atomic Energy Commission.

"Recent Developments and Results of the Gas-Synthesis Demonstration Plant, Louisiana, Mo." by J. H. Sandaker, R. G. Dressler, and J. A. Markovits, Bureau of Mines.

"Coal and Coal-Paste Preparation and Transfer Problems for Hydrogenation Service" by H. A. Remmert, L. C. Skinner, and J. T. Donovan, Bureau of Mines.

"Corrosion and Erosion in the Synthetic Fuels Demonstration Plant" by G. D. Gardner and J. T. Donovan, Bureau of Mines.

5:00 p.m.

Calvin W. Rice Lecture

Speaker: Colonel L. F. Urwick, London, England

Subject: Management's Debt to the Engineer

8:00 p.m.

Junior Conference

Speaker: Kenneth W. Haagensen, director of public relations, Allis-Chalmers Manufacturing Co., Milwaukee, Wis.

Subject: Engineering—Opportunity Unlimited

Tuesday, September 9, 9:30 a.m.

"The Outdoor Power Station in South Texas" by H. G. Hiebeler, Houston Lighting and Power Co.

"Optimum Design for Surface Condensers for Steam Power Plants" by J. T. Fong, Burns & Roe, Inc.

"Pressure Operation of Large Pulverized-Coal-Fired Boilers on the American Gas and Electric System" by G. W. Bice and W. M. Yeknik, American Gas and Electric Service Corp.

Gas Turbine Progress Report—1952 (I)

"Introduction" by R. Tom Sawyer, American Locomotive Co.

(Continued on page 62)

REVIEW OF NEW BOOKS

Any of the books here reviewed may be secured through Combustion Publishing Company, Inc., 200 Madison Ave., N. Y.

Methods of Analysis of Fuels and Oils

By J. R. Campbell

This book is a laboratory guide to the evaluation of gaseous, liquid and solid fuels, in accordance with British practice. Following a discusssion of the theoretical foundations of various text matter, the available analytical methods have been critically sifted and the best and simplest standard procedures included for the quantitative determination of the ingredients of all forms of fuel. These are clear constructions for assembling and using the test apparatus which are illustrated by carefully selected diagrams.

Particularly useful for chemists and fuel technicians, this book includes many tables of numerical data and equations for calculation of results. It contains 216 pages and sells for $4.

Handbook of Engineering Fundamentals

Edited by O. W. Eshbach

The first edition of this handbook brought out in 1936 established its place in engineering literature. In the present, or second, edition all fourteen chapters have been completely revised and expanded with the result that the total text has been enlarged by about 25 per cent.

The book is the work of some forty contributors, each a specialist in his particular field, under the editorship of Professor Eshbach who is dean of Northwestern Technological Institute, Evanston, Illinois.

Contents, by sections, include mathematical and physical tables; mathematics; physical units and standards; mechanics of rigid bodies; mechanics of deformable bodies; mechanics of incompressible fluids; aerodynamics; engineering thermodynamics; electricity and magnetism; radiation, light and acoustics; chemistry; metallic materials; non-metallic materials; and engineering law.

This last-named chapter embodies information that all practicing engineers will find most helpful. Included are an outline of the courts and their jurisdictions; definitions concerning contracts; mutuality, or offer and acceptance of contracts; their consideration, adequacy and underwriting; legal subject matter; competent parties; contractual formalities; the discharge of a contract; agency relationship and liability; mechanic's liens; torts; expert testimony; workmen's compensation; contract letting; qualifications of bidders; the contract documents; general and detailed specifications; and general requirements.

The book should prove a useful adjunct to any or all of the more specialized handbooks, each dealing with the several divisions of engineering. The price, in present $5\,^1/_2 \times 8\,^1/_2$ in. standard size and binding is $10.

Steam Power Plants

By A. H. Zerban and E. P. Nye

Today's mechanical engineering student is fortunate in having a wide range of well-written and effectively illustrated texts from which to study. This new book by two professors from The Pennsylvania State College is another addition to the growing lists of improved college texts which are also of value to the practicing engineer.

Intended basically for junior and senior students who have had some previous work in heat power, the text has three objectives:

1. To utilize fundamental principles of science toward the art of heat power engineering.

2. To bring to the attention of the student the economic factors that influence engineering decisions.

3. To give a general picture of the steam-power equipment of representative manufacturers.

The book includes chapters on power plant cycles, fuels, combustion, steady state heat transfer, furnace heat transfer, steam generators, steam power movers, fluid handling, instruments and controls, and internal combustion power plants.

The authors are to be commended for their judicious use of material from many of the better papers on steam power plant design presented before technical societies in the last few years by outstanding practicing engineers. They have also placed deserved emphasis upon the economic aspects of power generation and have refrained from including masses of minor details which not only confuse the student but which also can better be learned from practical experience than in the classroom.

All in all this book, which contains 524 pages and sells for $7.50, deserves wide use both as a text and by practicing engineers.

Thermodynamics in an Engineering Curriculum

By Myron Tribus

This 39-page bulletin, Research Series No. 114 of the Purdue Engineering Experiment Station, is of particular interest

because of the new thermodynamic energy concept proposed by Professor Neil P. Bailey of Rensselaer Polytechnic Institute and discussed in an editorial in April COMBUSTION. It contains much of the material presented in a series of three lectures covering the procedures and discussions used by Dr. Tribus in his presentation before the junior engineering classes at the University of California, Los Angeles.

Skill in thermodynamic reasoning, according to the author, should include at least the following:

1. The ability to define an ideal thermodynamic system and to recognize its boundaries.
2. The ability to apply the first law and to apply appropriate mathematical formulations of an energy balance with equal facility.
3. The ability to define the limitations imposed on a process by the second law. This should be based on the probability connotations of energy.
4. The ability to utilize data for an equation of state in the form of equation, tabular entries or a graph.

The major portion of this bulletin, which sells for $1, is devoted to showing how these skills can be utilized in teaching the principles and applications of the first and second laws of thermodynamics.

Combustion Handbook

This handbook published by the North American Mfg. Co., Cleveland, Ohio, has collected in one place a mass of very useful information for the non-specialist in combustion processes and has some information not readily found elsewhere. Its value is having all this under one cover.

There are 301 pages, including a glossary giving the common meanings for many terms met with in fuel-burning installations, 177 tables and 178 figures. The number of tables and figures indicates the information and the use of illustrations lessens the detailed descriptions. There are eight chapters taking the reader through the elements of combustion, the kinds of fuels and the effect of variables on the combustion process. Heat transfer and the flow of fluids is treated from the standpoint of losses of heat and pressure in transmitting fluids. The charts on burner equipment and combustion control are well illustrated and provide, therefore, a quicker means of identifying types and understanding the functioning. The more common systems of piping arrangements, etc., are illustrated in the last chapter. Much information is presented in the form of tables and drafts in the Appendix.

Selection of Gas-Making Oils

Methods of evaluating oils for gasification are presented in two new numbers of the Institute of Gas Technology Research Bulletin Series, No. 9, "Selection of Oils for Carbureted Water Gas," and No. 12, "Selection of Oils for High-Btu Oil Gas." Both are co-authored by E. S. Pettyjohn, the Institute's Director, and H. R Linden, assistant research director. The projects on which these publications are based were

sponsored by the Gas Production Research Committee under the PAR Plan of the American Gas Association.

The bulletins present data on the relationships of the physical and chemical characteristics of petroleum fractions, and of the operating variables, with the enriching values and with the qualities and quantities of the gaseous and liquid products. For the more common gas-making oils, these data are given in graphic as well as tabular form. Nomographs and equations included in the bulletins permit accurate calculations of these values for any oil, and indicate the operating variables most suitable for the selected oil and most favorable distribution between gaseous and liquid products.

Estimates of enriching value and oil gas yields, arrived at by the methods outlined, were compared with results obtained in plant operation, and found to be in good agreement, demonstrating the reliability of the procedures.

Bulletin No. 9 has 51 pages and sells for $4.00; Bulletin No. 12 has 48 pages and sells for $5.00; both are paperbound.

The Technique of Clear Writing

By Robert Gunning

Engineers, as undergraduate students, are prone to disparage English courses in composition and writing because they, superficially, appear to have little relationship to future engineering careers. This is a fallacious and incorrect viewpoint, the unfortunate results of which are exemplefied by the disappointing manner in which some outstandingly competent engineers write and later deliver technical papers before professional societies.

The author of this book has had outstanding success as a readability consultant and his firm has conducted readability surveys for the United Press ond Newsweek. It has also been responsible for clear writing training for such organizations as Standard Oil of New Jersey, B. F. Goodrich Company and the Baltimore and Ohio Railroad.

Knowing this background, the practicing engineer should approach this practical guide to writing with an idea something like this: he is capable of writing clear and convincing reports if he is only wise enough to apply the outlined principles thoughtfully.

The book opens with chapters telling what has been learned about the habits and preferences of readers. Then follows the second and longest part of the book in which ten principles of clear writing are elucidated. Part three has chapters entitled "The Fog in Your Newspapers," "Business Writing," "Legal Prose" and "Technical Writing."

For the engineer who wishes to write effectively the last chapters mentioned above deserve rereading several times. The author points out that the men of science most venerated are those skilled in communication. Even though the principal discoveries of Einstein are encased with deep mathematics, his prose is clear and direct and he does not add to the com-

plexity of his concepts by the use of foggy language. Dr. Gunning writes that most technical men and women talk clearly and concretely and are able to explain complex matters to a layman when they speak in oral communication. It is only when they begin to write that they shun simple English and slip into an odd jargon that they consider traditional and wise.

This 289-page book, which sells for $3.50, is worthy of serious consideration by all those engineers who wish to improve their skills in communication and are willing to learn and practice the technique of clear writing.

Regional Air Pollution Meeting

The Ninth Semi-Annual Meeting of the East Central Section of the Air Pollution and Smoke Prevention Association of America is scheduled for September 18 and 19 in the Kentucky Hotel in Louisville. Following are some of the more important papers scheduled for presentation:

Thursday, September 18

"Meterological Aspects of Air Pollution Control," by O. K. Anderson, U. S. Weather Bureau, Louisville, Ky.

"Incinerators," by Ellis Smauder, American Incinerator Corp., Detroit, Mich.

"Dust and Its Control," by John Kane, American Air Filter Corp., Louisville, Ky.

"Use of Radioactive Tracers in Air Pollution Study," by Edward G. Struxness, Atomic Energy Commission, Oak Ridge, Tenn.

"Past and Future Plans of Fuel Industry in the Control of Air Pollution," by H. B. Lammers, Coal Producers' Committee for Smoke Abatement, Cincinnati, Ohio.

"In-Plant Pollution and Its Effect on Out-Plant Pollution," by W. W. Stalker of the Department of Industrial Hygiene, State of Kentucky.

"National Association of Power Engineers' Approach to Air Pollution in Louisville," by Harry Lane, Louisville, Ky.

Friday, September 19

"Experience of an Air Pollution Division Operating on a State-Wide Level," by M. Sharrah, Director of Air Pollution Control, Department of Health, Commonwealth of Pennsylvania.

"Air Pollution Problems of Louisville—Past and Present," by J. L. Eschrich, "Courier Journal" and "Louisville Times."

"University of Louisville Dust Survey of Western Louisville, 1950," by Professor M. Carlson of the University of Louisville.

"Techniques Used in Sampling Particulate Matter in Cincinnati," by Edward Alpaugh of the Bureau of Smoke Inspection, Cincinnati, Ohio.

"The Trends of Railroad Motive Power and Its Effect on Air Pollution," by Carl Love, C. N. Wiggins and M. Johnson, Louisville & Nashville Railroad Co., Louisville, Ky.

(Continued from page 57)

"Materials, Cooling, and Fuels" by A. A. Hafer, Department of Navy.

"Thermodynamics" by P. F. Martinuzzi, Stevens Institute of Technology.

"Automotive" by F. L. Schwartz, University of Michigan.

"Railroad" by K. A. Browne, Chesapeake & Ohio Railway Co., J. I. Yellott, and P. R. Broadley, Locomotive Development Committee.

"Aviation" by Ivan Driggs and O. E. Lancaster, U. S. Navy.

12:15 p.m.

Gas-Turbine Power Luncheon

Speaker: Claude Seippel, director of research, Brown Boveri Co., Baden, Switzerland

Subject: Gas Turbines in Our Century

2:30 p.m.

Gas Turbine Progress Report 1952—(II)

"Marine" by W. A. Dolan, Jr., and A. A. Hafer, Department of Navy.

"Merchant Vessels" by W. A. Dolan and A. A. Hafer, Department of Navy.

"Naval Vessels" by W. A. Dolan and A. A. Hafer, Department of Navy.

"Central Station" by Lee Schneitter, Ebasco Services, Inc.

"Specialized Industrial Applications" by L. N. Rowley and B. G. Skrotski, McGraw-Hill Publishing Co.

Wednesday, September 10, 9:30 a.m.

"The Development of Gas-Turbine Controls" by G. Forrest Drake, Woodward Governor Co.

"The Application of Temperature Control to Turbojet Engines" by J. F. Engelberger and H. W. Kretsch, Manning, Maxwell & Moore Inc.

"Influence of Low-Quality Coals on Design and Operation of Pulverized-Fuel-Fired Units" by Otto de Lorenzi, Combustion Engineering-Superheater, Inc.

"Boiler Controls for Multiple-Fuel Firing in Modern Steam Generator Installations" by Alfred C. Wenzel, Republic Flow Meters Co.

Thursday, September 11, 12:15 p.m.

Roy V. Wright Luncheon and Lecture

Lecturer: The Honorable Ralph E. Flanders, United States Senator from Vermont

Subject: Engineering and Politics

2:30 p.m.

"Theoretical Consideration of Retarded Control" by Gerald H. Cohen and Geraldine A. Coon, Taylor Instrument Co.

"Direct-Reading, Indicating Power Meter" by Yao Tzu Li, Massachusetts Institute of Technology.

"Design of a Square Root Extracting Force Balance Pneumatic Flowmeter" by Arnold Goldberg, Goldberg Engineering Co.

"Direct Graphical Evaluation of Radiation Form Factor "F"" by F. C. Hooper and Stephen Juhasz, University of Toronto

"An Analysis of Laminar Free-Convection Flow and Heat Transfer About a Flat-Plate Parallel to the Direction of the Generating Body Force" by S. Ostrach, Lewis Flight Propulsion Laboratory.

Seventh National Instrument Conference and Exhibit

More than 100 outstanding scientists, engineers and technical specialists from government, educational and industrial organizations will address the Seventh National Instrument Conference to be held in the Public Auditorium, Cleveland, Ohio, Sept. 7–12, 1952. This gathering, sponsored by the Instrument Society of America, will include the American Institute of Physics, the ASME, the AIEE, the Institute of Radio Engineers, the Cleveland Physics Society and the Scientific Apparatus Makers Association. More than 10,000 are expected for the meeting which will be preceded by a Preconference ISA Instrument Maintenance Clinic beginning on Friday, September 5.

Portions of the program expected to be of specific interest to engineers in the steam power field include the following:

Tuesday, September 9, 10:00 a.m.

"A Smoke Density Recorder Using the Bolometer" by J. F. English, Bailey Meter Co.

Tuesday, September 9, 2:30 p.m.

"Design of High-Presssure Pumps" by R. W. Hiteshue and E. C. Clark, U. S. Bureau of Mines, Pittsburgh, Penna.

"A Sensitive Pressure Controller for High-Pressure Service" by P. L. Golden and A. F. Headerick, U. S. Bureau of Mines, Pittsburgh, Penna.

Wednesday, September 10, 2:30 p.m.

"Gaskets for High-Pressure Vessels" by Andrew R. Freeman, American Instrument Co., Silver Spring, Md.

"Design and Application of Controlled Volume Pumps for High Pressures" by D. H. Jones, Milton Roy Co., Philadelphia, Penna.

"Seals to Minimize Leakage at Higher Pressures" by B. A. Miemeier, Experiment, Inc., Richmond, Va.

Friday, September 12, 10:00 a.m.

"Instrumentation for Detection of Stack Discharges" by Gordon R. Hahn, Consolidated Edison Co. of New York.

Aerial Survey of Coal Stock

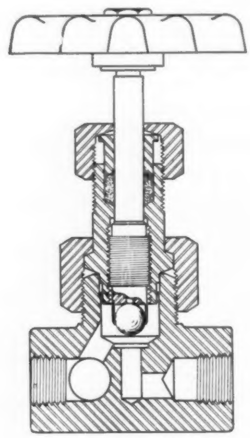
According to an announcement of the Bituminous Coal Institute, The Philadelphia Electric Company has initiated the use of a new aerial photo method to inventory "fuel on hand" in its enormous coal stockpiles. This new air survey system, used to check more than 500,000 tons of coal stored in ten different locations, obtained the inventory figures in days instead of weeks, and is claimed to have cut inventory costs by approximately 25 per cent.

The survey plane flew over the stockpiles at a set altitude. Using a precise timing device on the camera, the observers took two pictures of each seventy-five acre section, at slightly different angles. In this way, three-dimensional views of the terrain were obtained photographically, and the contours of each coal pile were shown exactly. Special plotting equipment quickly established the cubic volume of coal in each pile.

NEW EQUIPMENT

Ball Valve

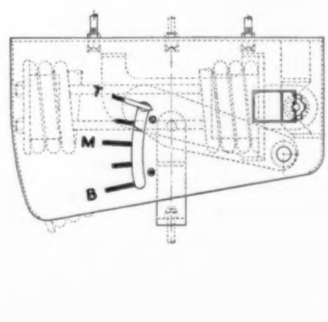
A new $^1/_4$-in ball valve of unique construction, recommended for working pressures up to 3000 psi, is announced by The Foxboro Co., Foxboro, Mass. Tight, positive shutoff is provided by a stainless steel ball which closes into a machined, conical seat. The ball, retained at the end of the stem, is free-rolling so that every closing brings a new surface into contact with the valve seat. Alignment of ball to seat is accurately piloted by a



forged steel, union-type bonnet, fitting tightly to the body and assuring a correct valve closure. The long-stroke stem and the packing gland are made of stainless steel for durability and resistance to corrosion. The packing is a preformed, graphited asbestos with a plastic binder and can easily be replaced without shutting off the line pressure or interrupting the process. Straight-through and angle types are available with two and four connections, meeting the wide range of valve-design requirements found in general industrial use, as well as in pilot plants and laboratories.

Pipe Hanger

Bergen Pipesupport Corp., an affiliate of the Bergen Iron and Engineering Co. of New Jersey, has announced a constant-support type hanger of new design. Many desirable features have been incorporated that are said to alleviate installation and operational problems. The



hanger achieves true constant support for piping under all load and travel conditions, being so constructed to permit normal longitudinal as well as transverse movement without impairing its efficiency. It has a minimum of moving parts, uses only one compression spring, and needs no compensating device. Permanently lubricated needle bearings and self-oiling bushings minimize friction, giving smooth, stable operation. The unit is of simplified construction, light in weight, compact, easy to install, requires little maintenance, and is practically foolproof. Substantially enclosed, it is protected against accidental damage and foreign matter. Visual inspection can be made from a considerable distance. Travel is indicated by a large pointer that has a full swing of approximately 7 in., irrespective of total travel. This pointer serves as a magnified direct reading indicator which simplifies initial setting and periodic checking. All positions are clearly marked by either large bars or brass buttons. The hanger is offered in 25 progressively graduated sizes ranging in travel from 2 in. to 12 in. and in load capacity from 50 lb. to 8380 lb. The units can be coupled or placed in multiples for increased capacity.

Flow Meter

Builders-Providence, Inc., Providence, R. I., has announced a redesign of the Model SMKS shuntflo meter for steam, air or gas, with the following improvements:

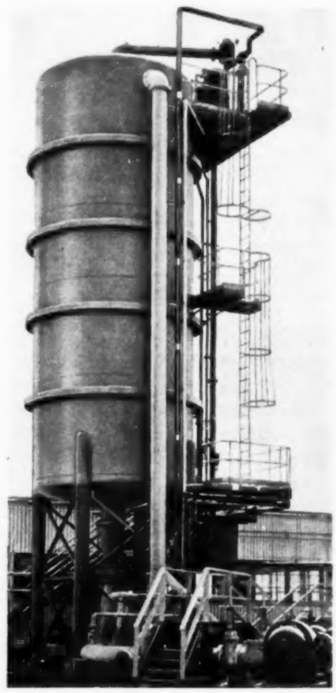
1. Streamline damping chamber to facilitate a more uniform cooling system.
2. All-Meehanite body casting for greater strength and durability.
3. A simplified rotor mechanism to assure greater efficiency of operation, easier replacement of parts and longer service.
4. Strengthened rotor shaft designed to withstand slugs of undue condensate in the line or sudden fluctuations in line pressure.

These Meters are used widely by district heating companies and in industry for departmental heating and process work.

Vacuum Deaerator

Engineered to a high degree of efficiency is a new vacuum deaerator developed by The Permutit Co., 330 W. 42nd St. New York, N. Y. This unit removes oxygen and free carbon dioxide from the water so as to protect piping, steel tanks and other equipment from the harmful effects of corrosion. The most frequently used method of deaeration for steam boilers is to raise the temperature of the water to the boiling point to make all gases insoluble and to scrub the boiling water with fresh steam. However, if the water is to be used cold, it is more practical to lower the boiling point by carrying out the process under vacuum. In operation, water is sprayed into the deaerator shell maintained under a vacuum or at an absolute pressure approximating the boiling point. Pressure in the unit is held at a vacuum of 29.75 in. with respect to a 30 in. barometer when deaerating water at 40 or 50 F respectively. The entering water is distributed over the top surface of a stack of trays or other packing. This packing subdivides the water particles repeatedly to expose new water surfaces to the gaseous phase. The non-condensable gases and water vapor are then drawn upwards through the packing and removed by vacuum pumps or steam ejectors.

This continual removal of gases scrubs the oxygen and carbon dioxide from the surface of the water and pro-



duces a higher partial vapor pressure in the lower part of the packing. The higher the partial vapor pressure, the lower will be the oxygen and carbon dioxide partial pressure and therefore, the less will be their solubility.

Downflow Purifier

Dirt, moisture, riser discharge and solids are removed before passing on to the distribution piping when this new internal downflow purifier is installed in an auxiliary tap immediately above evaporators, packed towers, deodorizers, stills, bubble-cap towers and inside steam drums, flash tanks, receivers and other vessels. Called internal-downflow Hi-eF Purifiers, and manufactured by the V.D. Anderson Co., 1935 W., 96th St., Cleveland, Ohio, they serve numerous functions, depending upon the application. They increase heating efficiency and protect pipe line equipment in steam application. In chemical and petroleum vessels they re-

cover valuable vapors. They increase production in evaporator operation and carry a guarantee to the boiler industry to deliver vapor with 1.0 ppm or less of total solids. In other applications the purifier is guaranteed to remove 99 per cent of all entrainment. A unique feature of these units is the separating element so designed that the units maintain a constant separating efficiency even as

velocities become greater. Removal of foreign matter is accomplished by means of a multi-stage centrifugal element which engages the entrainment laden vapor at the inlet at the top of the purifier as far away from the liquid level in the drug as possible.

In three stages by means of carefully controlled centrifugal force practically all dirt, moisture and riser discharges are removed. The cleaned stream is then passed on through the outlet of the vessel, while foreign matter is discharged to a drain. The design is such that there is no critical pressure drop through the unit. Although the unit illustrated is designed for downflow service, upflow purifiers are available. It is made in fabricated steel, stainless steel or other alloy materials in outlet sizes 4 in. to 24 in. furnished with slip joint connections or can be threaded in sizes 4 in. thru 10 in.

Centrifugal Pumps

Ingersoll-Rand Company, 11 Broadway, New York 4, N. Y., announces that it has redesigned their line of horizontal, multi-stage centrifugal pumps for medium-pressure applications, incorporating modern hydraulics that give

higher efficiency and better operation. These pumps, called the Class CNTA, are intended for boiler-feed, mine dewatering, marine, refinery and general industrial services to 800 lbs. Built in $1^1/_2$,

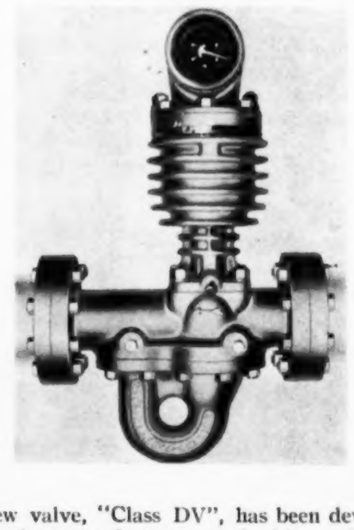
2, $2^1/_2$ and 3 in. sizes, units are available with 4, 6 or 8 stages. The Class CNTA pump features a horizontally split, smooth-bore cylindrical casing which contains the unit-type rotor assembly. This assembly is composed of the shaft, impellers and channel rings, which contain the multiple-volute fluid passages. The entire rotor assembly is quickly and easily removed from and installed in the smooth-bore casing, since there are no mating ring fits or delicate alignment problems.

A completely balanced rotor is assured through modern, multiple-volute design, which eliminates radial thrust at all conditions of operation. Back to back grouping of the impellers neutralizers axial thrust developed by the pressure differential across each individual stage.

The same interstage sealing method that is used in the manufacturer's higher pressure Class HMTA pumps is used in the CNTA line. This arrangement utilizes on alloy cast-iron or stainless-steel piston ring around the outer diameter of each individual channel ring. These hydraulic-type, step-seal rings have a metal-to-metal fit with the casing and are automatically placed under the correct compression when the casing halves are bolted together. They are highly resistant to corrosion and unaffected by high temperatures. Ball bearings, ring oiled from their own reservoirs are standard, although sleeve bearings may be obtained if desired. Stuffing boxes may be packed solid or arranged for injection or circulation, as best fits the application. The Cameron shaft seal may be installed in these pumps where difficult liquids are encountered. Water-cooled stuffing boxes are standard on pumps with steel casings and can be provided with cast-iron construction if requested.

Diaphragm Regulating Valve

A double-seated diaphragm regulating valve for use with control instruments has been announced by Leslie Co., 173 Delafield Ave., Lyndhurst, N. J. The



new valve, "Class DV", has been developed to meet features required by various process industries and provides, as standard equipment, features heretofore only obtainable in expensive, specially designed valves. Among the principal features

of the new valve is its "flow-line" contoured body, which has been designed to provide ISA standard face-to-face dimensions with the highest capacity, lowest turbulence and body pressure drop. Renewable interchangeable seat rings is another important feature of the new valve. These rings are machined so accurately that they can be removed and replaced without removing the valve body from the pipe line. This simplified maintenance eliminates the expensive practice of removing the body from the line and setting it up in a lathe to replace the seat rings. It also eliminates elaborate grinding operations at high temperatures. The new valve is available in sizes from $1^1/_2$ to 10 in. up to 600 psi, with screwed and flanged ends.

Chemical-Feed Packaged Unit

A chemical feed packaged unit, which delivers liquids in desired amounts under pressure, was announced by The Bird-Archer Co., 4337 N. American St., Philadelphia 40, Pa. This unit is suited

for feeding chemicals for boiler water treatment. The chemical reservoir tank is of sturdy welded steel construction, available in 50-or 100-gal capacity. The chemical proportioning pump can be designed for various rates of feed at different pressures. A specially designed motor-driven agitator assures completely mixed fluids at all times. A stainless steel strainer is provided between the suction side of the pump and the tank. The pump is mounted below the tank to minimize air biding and to maintain a positive suction head. A duplex-pump model with divided tank is also available. Both types of units are supplied complete with all necessary piping and are ready for connection.

Business Notes

Graver Water Conditioning Co. of New York has created a new research and development department under the direction of Vincent J. Calise. Marvin Lane will be technical manager. Also, it has placed its customer service in charge of W. J. Lewis.

Buell Engineering Co., manufacturer of dust-recovery equipment, has named J. A. McBride general manager and vice president in charge of sales.

General Electric Co. announces that William R. Herod has been elected a vice president, in addition to continuing as president of the International General Electric Co. which has lately become a division of the former.

The Swartwout Co., Cleveland, has opened a new district sales and service office for its power plant and autronic control divisions in Alhambra, Calif. It will be in charge of R. L. Gilliland.

L. J. Wing Mfg. Co., Linden, N. J., has added the following sales representatives: Eggelhof Engineers, Inc., for Tulsa, Okla., and Houston, Texas; Engineering Associates, Erie, Pa.; Hawaiian Equipment, Ltd., Honolulu; Guy Mankin, Jr., Kent, Conn.; Premier Industrial Ltd., Edmonton, Canada; and Industrial Equipment Co., Orlando, Fla.

The Copes-Vulcan Division of Continental Foundry & Machine Co. has been formed by a consolidation of the Northern Equipment Division, Erie, Pa., and Vulcan Soot Blower Division of DuBois, Pa. General offices and factory of the combined division are at 939 W. 26 St., Erie, Pa., where all activities of the two former independent divisions have been moved.

The Ladish Co., Cudahy, Wis., manufacturer of forged steel valves and seamless welded fittings, has appointed R. M. Bode to an executive sales position.

The Aldrich Pump Co., Allentown, Pa., manufacturer of reciprocating pumps for high-pressure service, is commemorating its fiftieth anniversary. It originated as the Aldrich Pump Department of the Allentown Rolling Mills which, with a background of 107 years, ended its existence last November through merger with the Aldrich Pump Co.

Allis-Chalmers Manufacturing Co. has announced the retirement on July 31 of Soren H. Mortensen, for a number of years chief engineer of its power department; also, the simultaneous retirement of his assistant, Fraser Jeffrey. Both men are pioneers in the electrical industry and widely known through their numerous technical writings and appearance before engineering groups.

Hagan Corporation, combustion and chemical engineering firm, has purchased American Cast Products, Inc., Orrville, Ohio.

No personnel changes are contemplated in organization of this old-established grey iron foundry. Neil A. Benson, plant manager, Hagan Orrville plant, will directly supervise operations of American Cast Products, Inc., as a wholly owned subsidiary. J. Carl Hall will continue as sales manager of the foundry and assist in its operation.

The foundry will continue to serve its customers for grey iron castings under the same manufacturing and sales policies.

Association Changes Name

Because of its length, the name of the Air Pollution and Smoke Prevention Association of America has been changed to the more convenient title "Air Pollution Control Association." This action was proposed at this year's annual meeting at Cleveland in June and later confirmed by letter ballot of the membership. The headquarters remain at 4400 Fifth Avenue, Pittsburgh 13, Pennsylvania, with Robert T. Griebling executive secretary.

Second Nuclear-Powered Submarine

According to the National Production Authority the Navy has contracted for a second nuclear-powered submarine, the power plant of which will differ from that of the Nautilus, the keel for which was recently laid. The design of this second power plant was developed by the Knolls Atomic Laboratory and utilizes an intermediate neutron energy and a liquid-metal coolant.

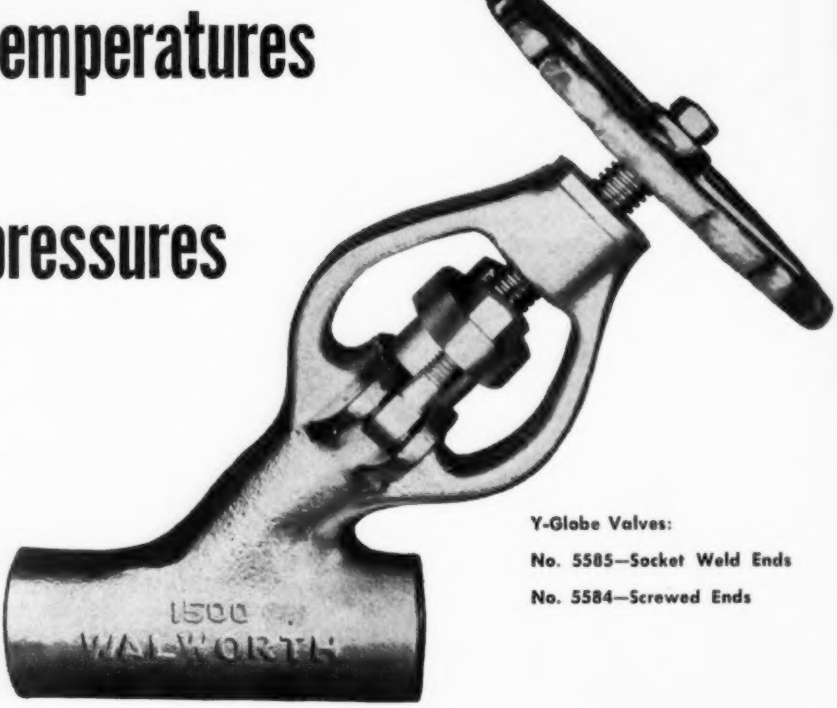
The new submarine, which will cost the Navy over 32 million dollars, exclusive of costs borne by the Atomic Energy Commission, is expected to operate under water at a speed in excess of 20 knots.

Walworth's NEW small cast steel valves

SERIES 1500 — SIZES ¼ to 2 inches

handle HIGH temperatures, HIGH pressures

Walworth is proud to make these new Small Cast Steel Valves available to power stations . . . oil refineries . . . ships . . . wherever piping is subject to severe pressures and temperatures. Non-shock service ratings of these valves: 1500 psi–950F for steam; 3600 psi–100F for water, oil or gas. Cast of chromium molybdenum steel, they are compact and light, yet exceptionally strong. Both Y-Globe and Angle type valves are available.



Y-Globe Valves:

No. 5585—Socket Weld Ends

No. 5584—Screwed Ends

Simplified Walworth design eliminates many of the valve problems encountered in high pressure service. Among the features of this new valve are:

INTEGRAL BODY AND YOKE — made from a single casting without threading or welding. Bonnet joint — always a potential source of leakage — is eliminated. Valves can be reassembled quickly and easily.

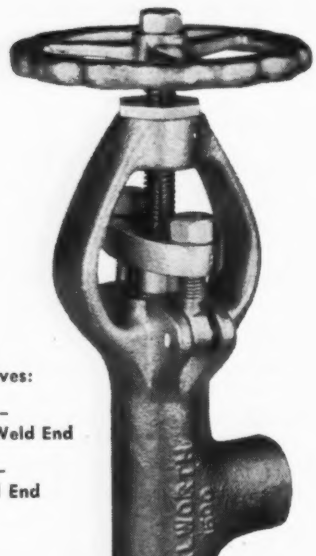
ROTATING DISC — prevents valve seat distortion and consequent leakage. Cuts down replacements.

WELDED SEAT RING — compensates for changes in pressure and temperature—eliminates a major source of leakage.

SPECIAL BACK SEAT BUSHING — permits repacking the valve under pressure with greater safety.

PACKING CHAMBER — designed to dissipate heat thus keeping packing rings at lower temperatures—gives them longer life.

These valves are available with either socket weld ends or screwed ends, in sizes ranging from ¼ to 2 inches. For further information on Walworth series 1500 Small Cast Steel Valves, see your local Walworth distributor, or write for Circular No. 134.



Angle Valves:

No. 5587—Socket Weld End

No. 5586—Screwed End

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